

Muelleria

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CONTENTS

	Page
Studies in Antarctic Lichens I: Notes on <i>Caloplaca citrina</i> (Hoffm.) Th. Fr. and <i>Physcia caesia</i> (Hoffm.) Hampe—R. B. Filson	1
Studies in Antarctic Lichens II: Lichens from the Windmill Islands, Wilkes Land—R. B. Filson	9
Taxonomy and distribution of <i>Rubus fruticosus</i> L. agg. (Rosaceae) naturalized in Victoria—R. L. Amor and the late B. A. Miles	37
A yellow form of the Tasmanian Waratah, <i>Telopea truncata</i> (Labill.) R. Br.—A. M. Gray	63
The status of <i>Bedfordia</i> on the Australian Mainland—A. M. Gray	64
Book reviews	67

MUELLERIA

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STUDIES IN ANTARCTIC LICHENS I:

Notes on *Caloplaca citrina* (Hoffm.) Th.Fr.

and *Physcia caesia* (Hoffm.) Hampe.

by

REX B. FILSON*

SUMMARY

In a previous paper (Filson, 1966), the author discussed two species of lichen, *Parmelia coreyi* Dodge & Baker and *Pyrenodesmia mawsonii* Dodge but at that time he was uncertain of their correct systematic position. In this paper *Pyrenodesmia mawsonii* Dodge is discussed with the suggestion that it should be treated as a synonym of *Caloplaca citrina* (Hoffm.) Th.Fr. Three species of *Parmelia*, *P. coreyi* Dodge & Baker, *P. johnstoni* Dodge and *P. variolosa* Dodge & Baker, are placed in synonymy under *Physcia caesia* (Hoffm.) Hampe.

MATERIALS

The author desires to point out first that he has not seen type material of any of the species discussed in this paper and bases his conclusions on specimens determined by Dr. Carroll Dodge. These specimens, housed in the National Herbarium of Victoria, form part of a large batch of B.A.N.Z.A.R.E. lichen material found in the basement of the University of Adelaide in 1972.

The author has also received extensive lichen collections from all Australian Antarctic bases as part of the current biological programme.

DISCUSSION

Caloplaca citrina (Hoffm.) Th.Fr. in *Nova Acta Sci. Upsal.*, Ser. 3 3: 218 (1861).

Verrucaria citrina Hoffm. *Deutschl. Flora* 198 (1796).

Pyrenodesmia mawsonii Dodge in *B.A.N.Z. Antarct. Res. Exped. Rep.* 7: 232 (1948).

* National Herbarium of Victoria.

There were no authenticated collections of *Pyrenodesmia mawsonii* in Australian herbaria at the time Filson (1966) wrote his Mac.Robertson Land paper and he was uncertain about referring material to this species. In the light of more ample collections it is now possible to interpret more accurately Dodge's original description (Dodge, 1948: 232). In his description Dodge does not mention the presence of soredia and as this feature is very pronounced in the specimens on which the present author based his interpretation of the species, it raises some doubt as to whether Professor Dodge and the author were in fact discussing the same taxon.

However, from the description given in Dodge, the small pulvinate marginate squamules found growing over mosses in the Mac.Robertson Land region clearly fit the description of *Pyrenodesmia mawsonii* when in a non-sorediate condition. These squamules are also identical with specimens of *Caloplaca citrina* (Hoffm.) Th.Fr. found growing in Australia. All of the Antarctic material seen by the present author is sterile, but the apothecial details of Australian specimens of *Caloplaca citrina* compare favorably with those given by Dodge for *Pyrenodesmia mawsonii*.

It is certain that collections from Antarctica referred to *Pyrenodesmia mawsonii* by Filson are *Caloplaca citrina* and it is almost certain that *Pyrenodesmia mawsonii* should be placed in synonymy under it.

SPECIMENS EXAMINED (additional to Filson, 1966):

Princess Elizabeth Land—valley south from Club Lake, Vestfold Hills, Knowles Kerry, 4.i.1973 (MEL 1011943); Filla Island, Rauer Group, Knowles Kerry, 9.i.1973 (MEL 1011944); Hop Island, Rauer Group, Knowles Kerry, 8.i.1973 (MEL 1011950); Lichen Island, Knowles Kerry, 7.xii.1972 (MEL 1011969).

Mac.Robertson Land—Mawson, A. M. Gwynn A.N.A.R.E. AB/54 Li40, ii.1954 (Mel 1011970).

Australia—14.5 km east of Cooma on the Numeralla road, N.S.W., Rex Filson 7883b, 2.xii.1965 (MEL 26315 p.p.); Wyperfeld National Park, Victoria, Rex Filson 14328, 17.xi.1971 (MEL 1010666); Bailey's Rocks, 12 km east of Poolaijelo, 51.5 km north of Casterton, Victoria, Rex Filson 14699, 18.v.1973 (MEL 1011972).

Yugoslavia—Dalmatia, Insula Korcula, Banja Zrnovska, A. Vezda, 12.vii.1968 (MEL 1010876).

PLATE 1.

Caloplaca citrina (Hoffm.) Th.Fr. a. Specimen, MEL 9109, from Casey Range, Mac.Robertson Land, Antarctica, growing on sandy soil. b. Specimen, MEL 1011972, from Bailey's Rocks, 12.87 km east of Poolaijelo, Western Victoria, Australia, growing on rock. c. Specimen, MEL 1011969, from near the summit cairn, Lichen Island, Princess Elizabeth Land, Antarctica.

PLATE 1



Physcia caesia (Hoffm.) Hampe in Fürnr. Naturh. Topogr. Regensburg. 2: 250 (1839).

Lichen caesius Hoffm. Enum. Lich. 65 (1784).

Parmelia variolosa Dodge & Baker in Ann. Miss. Bot. Gard. 25: 592 (1938).

Parmelia coreyi Dodge & Baker l.c. 593 (1938).

Parmelia johnstoni Dodge in B.A.N.Z. Antarct. Res. Exped. Rep. 7: 191 (1948).

Filson (1966) was dubious as to the systematic position of *Parmelia coreyi* Dodge & Baker. The ashy-white thallus seemed to suggest a species of *Physcia* rather than *Parmelia*. He has now had the opportunity of studying more material from the Antarctic as well as from Australia and other localities.

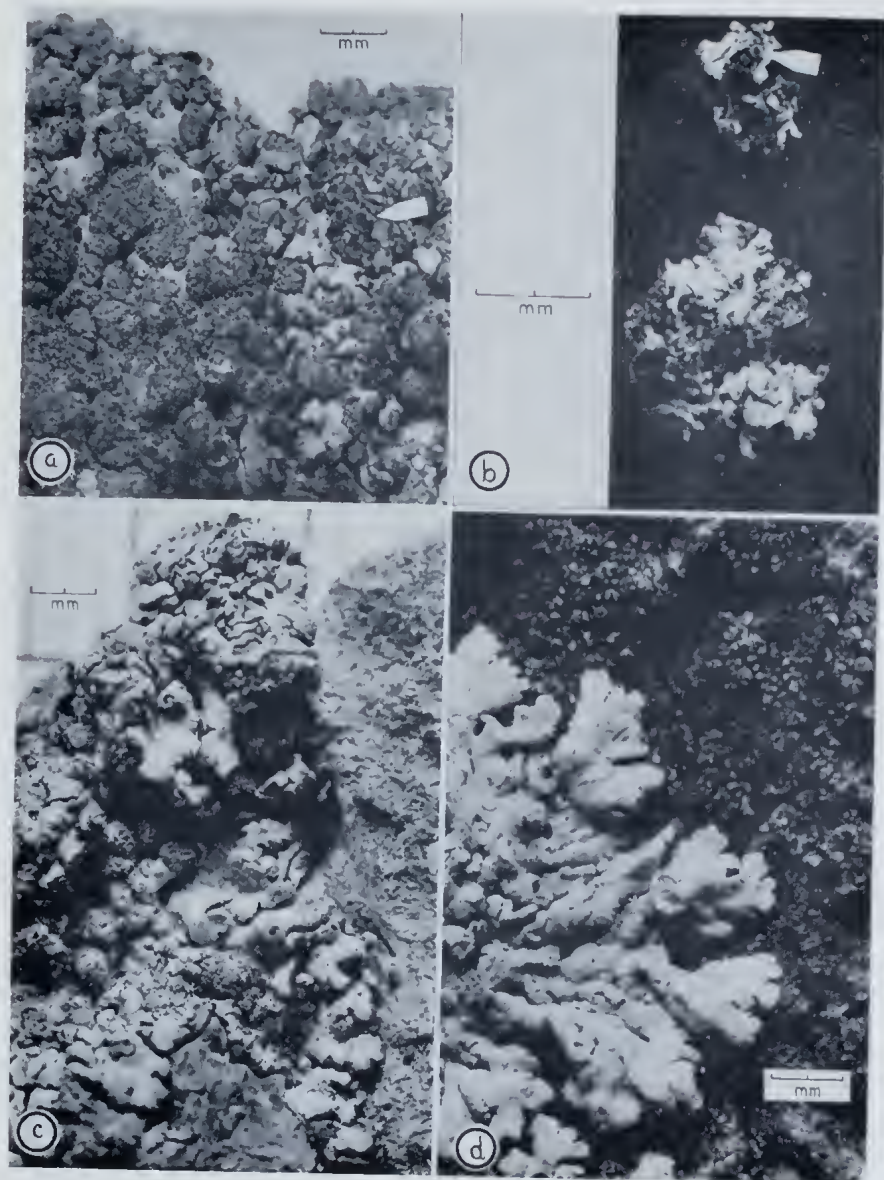
In Antarctica the thallus of this species is fragile, ashy-white to bluish-grey, with the older portions heavily maculate and sometimes bleaching to white and then yellowish on the top where they come in contact with snow and frozen particles. Soralia are present and the older lobes sometimes dissolve into a mass of thick granular soredia. It is extremely variable in lobe width. Thalli growing on rock are more robust than those growing over mosses. The latter thalli tend to be finer with their lobes becoming more strongly concave as the thallus presses into the moss heads. *Parmelia variolosa* represents this finer form and the "smooth, pruinose primuline yellow" described by Dodge & Baker (1938: 594) is caused by bleaching but in protected places between moss heads and on the undersides of the cushions the thallus is grey and maculate. The yellow bleaching effect has been noted in the typical form when it grows over the tops of stones where exposure conditions are similar. The Antarctic population of this lichen is macroscopically indistinguishable from *Physcia caesia* as found in Australia.

The most definite feature that separates the genera *Parmelia* and *Physcia* concerns the spores. In *Parmelia* the spores are simple and colourless, but they are two-celled and dark in *Physcia*. There seems to be some confusion in the interpretation of the specimens examined by their respective authors when they first described these three entities (*Parmelia variolosa*, *P. coreyi* and *P. johnstoni*) as distinct species.

PLATE 2.

Physcia caesia (Hoffm.) Hampe a. Specimen, MEL 1011966, from Mawson, Mac.Robertson Land, determined as *Parmelia johnstoni* by Dodge. Apothecia are those of *Lecanora expectans* Darb. b. Specimen, MEL 1011925, from Cape Bruce, Mac.Robertson Land, determined as *Parmelia variolosa* by Dodge. Apothecia are those of *Lecanora expectans* Darb. c. Detail of MEL 1011966 showing the thallus lobe edges and the soralia. d. Specimen, MEL 28055, from Ranga Cave, Flinders Island, Bass Strait, Australia, showing the thallus lobe edges and soralia.

PLATE 2



In *Parmelia coreyi* the apothecia were described as rare. All of the material of *P. johnstoni* was "badly fragmented, whether in formalin or dried, so it is has been very difficult to interpret. The apothecia are all old or very young, with only traces of the thecium left." (Dodge, 1948 : 191). The discussion on *P. variolosa* says "The apothecia are extremely rare, and it is difficult to establish their identity with the thallus. Apparently in the apothecial regions the thallus enlarges, becomes distorted and more floccose with an increased algal content." (Dodge & Baker, 1938 : 594). The present author has seen fragmentary material determined by Dodge as *P. variolosa* from Cape Bruce. It contains distorted areolae with apothecia (photo, plate 2b). The apothecia are up to 0.5 mm in diameter, more or less circular with a prominent margin and the disk is reddish-brown. The areolae are similar to those of *Lecanora expectans* Darb. A specimen from Mawson (Gwynn, AB/54/Li44) also has apothecia and this specimen (photo, plate 2a) has been identified in the past as *Parmelia johnstoni* Dodge. The thallus lobes are like those of *Physcia caesia*, whilst the apothecia actually resemble those of *Lecanora expectans* and are not attached to the *Physcia* lobes at all but are in fact growing up between them. This confusion certainly has arisen because the material was collected in a fragmentary condition and the authors of the names did not have the opportunity to study the specimens in the field.

Filson (1966 : 57) suggested that *Parmelia coreyi*, *P. johnstonii* and *P. leucoblephara* all represented the same species. This opinion is erroneous because *P. leucoblephara* was described (Dodge & Baker, 1938 : 593) as having long branched cilia. This feature excludes it from being included in the other two species as formerly understood. Further discussion on *Parmelia leucoblephara* will be presented in another paper.

The chemistry of the Antarctic material is the same as that for the Australian specimens—thallus and medulla K + yellow, and both atranorine and zeorine has been demonstrated in G.E.

SPECIMENS EXAMINED (additional to Filson, 1966):

Mac.Robertson Land—Mawson, A. M. Gwynn A.N.A.R.E. AB/54/Li44, ii.1954 (MEL 1011966) [this specimen is cited in Dodge (1955 : 145) as Li22 *Parmelia johnstoni* and in a personal communication with the Antarctic Division, Melbourne as "sterile and more sorediate than usual"]; Mawson, A. M. Gwynn A.N.A.R.E. AB/54/Li43, ii.1954 (MEL 1011965) [cited in Dodge (1955) as Li23 *Parmelia johnstonii*]; Mawson, R. O. Summers A.N.A.R.E. AB/54/Li54, i.1954 (MEL 1011967); Mawson, R. O. Summers, A.N.A.R.E. AB/54/Li58, i.1954 (MEL 1011968); rocks

PLATE 3.

Crystals produced by substances in the microcrystal test solutions, recrystallized from the acetone extract of *Physcia caesia* (Hoffm.) Hampe, collected at Mawson, Mac.Robertson Land, A. M. Gwynn ANARE AB/54/Li43, ii.1954 (MEL 1011965). a. Atranorine recrystallized in G.E. b. Zeorine recrystallized in G.E.

PLATE 3



near shore, Cape Bruce, B.A.N.Z.A.R.E. 108-18, 18.ii.1931 (AD) [cited in Dodge (1948 : 192) as *Parmelia johnstonii*]; rocks near the shore, Cape Bruce, B.A.N.Z.A.R.E. 108-39, 18.ii.1931 (MEL 1011925).

Queen Mary Land—L/II. Possession Nunatak, C. T. Harrison A.A.E. 61-1, 25.xii.1912 (AD) [cited in Dodge (1948 : 193) as *Parmelia variolosa*.]

King George V (Adelie) Land—Cape Denison, D. Mawson A.A.E. 16, 1912 (AD) [cited in Dodge (1948 : 193) as *Parmelia variolosa*.]

Wilkes Land—Bailey Peninsula, near Rx site, Casey Station, Budd Coast, D. J. Luders CB72/05b, 19.ix.1972 (MEL 1011988).

Princess Elizabeth Land—Adjacent to Flying Fox over the Ellis Fjord, Vestfold Hills, Knowles Kerry A.N.A.R.E., 4.i.1973 (MEL 1011940); near summit cairn, Lichen Island, Knowles Kerry A.N.A.R.E., 7.xii.1972 (MEL 1011973).

Australia—14.5km east of Cooma on the Numeralla road, N.S.W., Rex Filson 7883, 2.xii.1965 (MEL 26315 p.p.); Little River Gorge, 8 km east of Wulgulmerang, Victoria, Rex Filson 8363, 9.iii.1966 (MEL 26323); Ranga Cave, Flinders Island, Furneaux Group, Bass Strait, John Whinray, 23.xii.1966 (MEL 28055); eastern end of South-east beach, Babel Island, Furneaux Group, Bass Strait, John Whinray, 12.ii.1967 (MEL 28069).

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The author wishes to thank the Keeper, State Herbarium of South Australia, for the loan of specimens from the B.A.N.Z.A.R.E. collections. To the Botany Department, University of Adelaide, and especially to Mr. R. D. Seppelt, he is particularly grateful for the small B.A.N.Z.A.R.E. collection donated to the Melbourne Herbarium. To Dr. D. M. Churchill and to the Dept. of Lands Photographic Section he extends his thanks for assistance with the photographs. The assistance of Dr. Knowles Kerry who made additional collections on the Antarctic continent is gratefully acknowledged.

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 Thomson, J. W. (1963)—The Lichen Genus *Physcia* in North America. *Nova Hedwigia Beiheft* 7 : 172pp.
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STUDIES IN ANTARCTIC LICHENS II: Lichens from the Windmill Islands, Wilkes Land.

by
REX B. FILSON*

SUMMARY

The lichen collections from the Windmill Islands are enumerated together with a key and description of each species. Two new species, *Buellia soledians* and *Lecidea andersonii*, are described and figured. Figures are provided for those species not already illustrated in the author's *The Lichens and Mosses of Mac.Robertson Land* (Filson, 1966).

INTRODUCTION

The Windmill Islands are a group of islands and peninsulas on the eastern side of Vincennes Bay on the Budd Coast, Wilkes Land, at approximately 66° 20'S. and 110° 30'E. They were first visited by U.S. Navy Survey ships during "Operation Windmill" in 1947-48 and later on by the Australian National Antarctic Research Expedition (ANARE) in 1956. In 1956, the Russian Survey Expedition also visited these islands. The U.S. National Academy of Sciences chose this locality for a station during the International Geophysical Year, and the construction of "Wilkes" Station at the western tip of the Clarke Peninsula was completed by U.S. Operation Deepfreeze II early in 1957. The United States operated Wilkes Station until 1959 when it was handed over to ANARE for use by Australian scientists. Wilkes was used by ANARE until 1969 when it was replaced by the more modern "Casey" station on the northern side of the Bailey Peninsula.

VEGETATION

The vegetation of the area consists almost entirely of lichens but a few mosses occur there also. Llano (1959: 11) reported: "The area around IGY Wilkes Station was biologically the richest of all those investigated. The dominant lichen, *Umbilicaria* was well represented by the cosmopolitan *Umbilicaria decussata*, The wide variety and extent of the cryptogamic flora suggests that the land area around Vincennes Bay has been exposed for a long time."

Apart from these notes, no comprehensive report on the flora has been published. As part of his *Lichenological Notes on the Flora of the Antarctic Continent and the Subantarctic Islands* series, Dodge (1965: 528) described *Physcia llanoi* as a

* National Herbarium of Victoria.

Muelleria 3 (1) : 9-36 (1974).

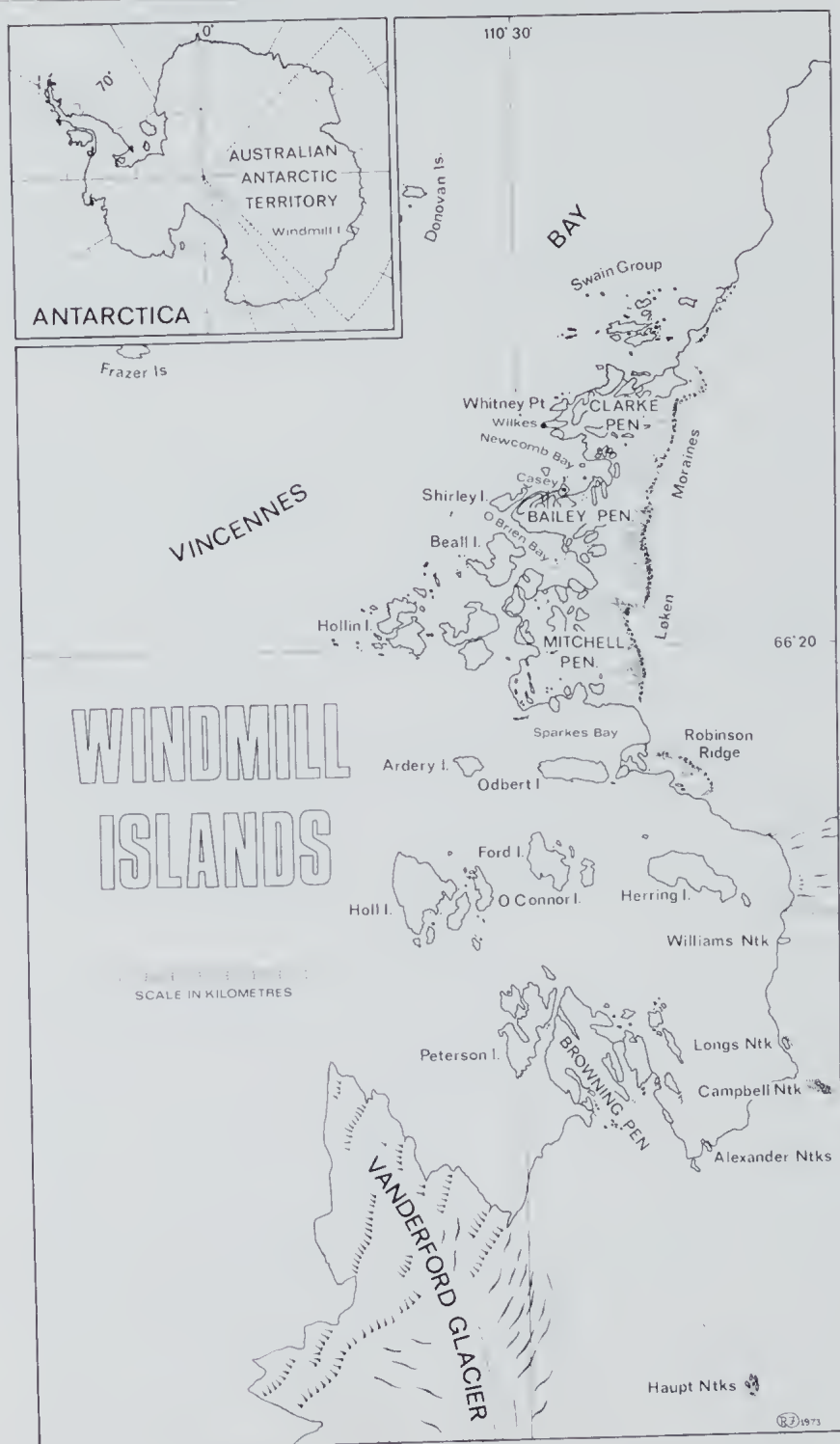


Fig. 1.—Map of part of the Budd Coast showing the Windmill Islands.

new species from Wilkes Station. The present author has not seen the type material of this species but suggests that it might prove to be conspecific with *Physcia caesia* (Hoffm.) Hampe because ample material of this latter species was collected in the same locality by K. S. White in 1966. According to the type description, *Physcia llanoi* seems to be a non-sorediose species, but many non-sorediose lobes have been noted amongst the present collections and this condition could lead to confusion.

In a further issue of this series, Dodge (1968) described two more new species, *Buellia llanoi* which from the description



Fig. 2—Aerial view south-west over the Clarke Peninsula towards Casey. The Vanderford Glacier Tongue lies on the horizon. ANARE Photo 25553.

appears to be a colour variation of *Buellia frigida* Darb., and *Thelidium llanoi* which represents a genus unrepresented in our collections.

GEOLOGY

The geology of the Windmill Islands has been treated in a preliminary report on the Bedrock Geology (Robertson, 1959) and the following summary of each of the collecting areas is based on this report.

Clarke Peninsula is composed of migmatite which consists of approximately 65 per cent gneiss and 35 per cent granitic material. The migmatite exhibits many small folds which are

superimposed on the southern limb of the large syncline, the axis of which lies north of the peninsula. *Bailey Peninsula* is almost entirely migmatite and the rest is slightly garnetiferous biotite granite. The migmatite consists of approximately 80 per cent granitic phase and 20 per cent biotite or hornblende gneiss. *Mitchell Peninsula* has low rolling hills on the southern limb of the anticline and consists of migmatite in similar proportions to *Bailey Peninsula*. The migmatite is cut by a sub-parallel system of diabase dykes. The granite phase of the migmatite is granitoid, creamy coloured and slightly foliated. *Robertson Ridge* consists of igneous rocks in the central portion, but north and south sides consist of altered metamorphic rocks while the south-west corner exhibits a variety of altered rocks. This area shows the best exposure of the contact of the gneiss and the intermediate rocks of the stock. *Odbert Island* lies to the west of *Robertson Ridge*. Its bedrock is quartz diorite and represents the northern limit of the stock. Two wide vertical fine-grained black diabase dykes altered to a more basic rock type occur here. *Browning Peninsula* and *Peterson Island* are separated from one another by a narrow channel developed along a fault. The most abundant rocks are grey, coarse porphyritic diorites, quartz diorite and granite which are all weathered to rusty brown. They are part of a stock which is intruded by gabbro dykes. The *Haupt Nunataks* cover about 16 hectares and consist mainly of gneisses and gneissic granite. They are fine-to-medium-grained buff to black and white rocks that weather to a rusty brown.

ARRANGEMENT OF THE GENERA

Acarosporaceae: *Biatorella*

Lecanoraceae: *Lecanora*

Lecideaceae: *Lecidea*

Physciaceae: *Buellia*, *Physcia*, *Rinodina*

Teloschistaceae: *Caloplaca*, *Protoblastenia*, *Xanthoria*

Umbilicariaceae: *Umbilicaria*

Usneaceae: *Alectoria*, *Usnea*

KEY TO THE WILKES LAND LICHENS

1. Thallus foliose or fruticose
 2. Thallus more than 1.5 cm tall
 3. Soredia pulvinate to subglobose.....24 *Usnea acromelana*
 3. Soredia eroded, convexed, abundant in the upper parts.....25 *Usnea antarctica*
 2. Thallus less than 1.5 cm tall
 4. Thallus umbilicate, usually a smooth or rugulose disc, mono-or phyllous

5. Lower surface with a few tufts of rhizines at the margins, thallus small, upper surface smooth or verrucose.....21 *Umbilicaria cristata*
5. Lower surface without rhizines, upper surface reticulately rugose.....20 *Umbilicaria decussata*
4. Thallus neither umbilicate nor monophyllous
 6. Thallus greenish-orange to flame-scarlet.....19 *Xanthoria mawsonii*
 6. Thallus not greenish-orange to flame-scarlet
 7. Thallus lobes broad, imbricate, pale grey to brownish-grey, sorediose.....11 *Physcia caesia*
 7. Thallus lobes narrow terete, pale brownish to black, esorediose
 8. Thallus branches loosely entangled, never forming rosettes.....23 *Alectoria pubescens*
 8. Thallus branches adnate to the substrate, forming rosettes.....22 *Alectoria minuscula*
1. Thallus crustose or squamulose
 9. Thallus orange, yellow or greenish-yellow
 10. Upper cortex K—
 11. Thallus granular-sorediose; apothecia small and immersed in granules; ascus 8-spored.....18 *Protoblastenia citrina*
 11. Thallus esorediose; apothecia large, hemispheric; ascus polyspored.....1 *Biatorrella antarctica*
 10. Upper cortex K+ purple
 12. Thallus effigurate, forming large orange to flame scarlet rosettes; apothecia usually abundant.....17 *Caloplaca elegans* var. *pulvinata*
 12. Thallus neither effigurate nor forming large rosettes, greenish-yellow to orange
 13. Thallus sorediose; apothecia rare.....16 *Caloplaca citrina*
 13. Thallus absent; apothecia abundant.....15 *Caloplaca athallina*
 9. Thallus never orange, yellow nor greenish-yellow
 14. Spores brown
 15. Apothecia lecanorine
 16. Thallus growing on rock.....13 *Rinodina petermannii*
 16. Thallus growing over mosses or other lichens

- 17. Apothecia 1.0 — 1.5mm diam., spores
25 — 30 μ \times 10 — 11 μ14 *Rinodina turfacea*
- 17. Apothecia 0.3 — 1.0mm diam., spores
16 — 21 μ \times 8 — 9 μ12 *Rinodina archaeoides*
- 15. Apothecia lecideoid
- 18. Thallus effigurate
 - 19. Hypothallus not developed.....5 *Buellia frigida*
 - 19. Hypothallus developed.....7 *Buellia latemarginata*
- 18. Thallus not effigurate
 - 20. Thallus growing on rock, usually with a dark radiate hypothallus
 - 21. Thallus sorediose.....10 *Buellia soredians*
 - 21. Thallus not sorediose.....8 *Buellia lignoides*
 - 20. Thallus growing over mosses
 - 22. Epithecium HNO₃ + purple-red, medulla 1 +6 *Buellia grimmiae*
 - 22. Epithecium HNO₃ —, medulla 1 —9 *Buellia cf. papillata*
- 14. Spores hyaline
 - 23. Apothecia brown or black
 - 24. Apothecia brown, margin concolorous with the thallus.....2 *Lecanora expectans*
 - 24. Apothecia black, margin concolorous with the disc.....4 *Lecidea andersonii*
 - 23. Apothecia cream, pinkish, greenish or dark green
.....3 *Lecanora rubina* var. *melanophthalma* forma *exsulans*

DESCRIPTION OF THE SPECIES

1. *Biatorrella antarctica* Murray in *Trans. Roy. Soc. NZ.* 2: 60 (1963).

Thallus in cerebriform humped areoles up to 3cm diam., and up to 10mm thick, bright sulphur-yellow, greenish in sheltered areas, held to the substratum by thin white hyphae which sometime penetrate deeply into the cracks in the rock. *Cortex* up to 50 μ thick. *Algal cells* 8 — 13 μ diam., forming scattered colonies throughout the medulla. *Medulla* of moderately woven hyaline branched hyphae 2.5 — 3.0 μ diam. *Apothecia* up to 1.5 mm diam., convex to hemispheric, margin visible at first but disappearing at maturity. *Disk* sulphur-yellow or sometimes yellow-green, waxy. *Hymenium* hyaline, 65 — 85 μ high including

the epithecium. *Epithecium* pale yellow, heavily encrusted with yellow crystals. *Paraphyses* regularly branched once or twice near the tips, 2μ diam., apical cell slightly expanded. *Asci* $50 \times 16\mu$ broadly clavate, with over 150 spores. *Ascospores* hyaline, ellipsoidal, unicellular, $2-3 \times 2\mu$.

REACTIONS: K—, C—, P—, KC—, I—, UV+ orange, hymenium I+ blue fading.

SPECIMEN EXAMINED: Bailey Peninsula, 1.5 km south of Casey Station, D. J. Bishop, 15.iii.1970 (MEL 1012061).

DISCUSSION: The only specimen collected in this area is represented by eight small areolae, each up to 1.5 mm in diameter. Although these are sterile, they agree in detail with those found elsewhere. The apothecial measurements, quoted in the above description, are based on specimens from Mac.Robertson Land and are included here because the author feels certain that fertile specimens will eventually be located in this present study area.

2. *Lecanora expectans* Darb. in *Nat. Antarct. Exped. 1901-1904*, *Nat. Hist.* 5 : 7 (1910).

Thallus of small granules formed into rugose chunky areoles in areas up to 5 mm diam., greyish white, cinereous, ecorticate. *Algal cells* up to 25μ diam., densely packed and forming a layer below the apothecia. *Apothecia* up to 1.2 mm diam., round to irregular, pruinose, disk reddish-brown to black. *Margin* concolorous with the thallus, crenulate, pruinose, inrolled at first, expanding but remaining elevated well above the disk. *Cortex* continuous with the thallus, up to 30μ thick. *Hymenium* $50-65\mu$ high including the brownish epithecium. *Paraphyses* straight, septate, simple, apical cell slightly expanded and covered by a large dark, gelatinous sheath 7μ diam. and 10μ long. *Ascus* $30-60 \times 12-16\mu$, clavate, 8-spored. *Ascospores* $12-17 \times 5-7\mu$, ellipsoid, slightly reniform, hyaline.

REACTIONS: K—, hymenium I+ deep blue, medulla I—, epithecium HNO_3 —.

SPECIMEN EXAMINED: Bailey Peninsula, near Rx site, D. J. Luders CB72/05d, 8.xi.1972 (MEL 1011990).

DISCUSSION: The only specimen seen in this present study was typical of the species and it is represented by a small colony 1.3 cm diam. growing over moss.

3. *Lecanora rubina* Ach. var. *melanophthalma* (Ram.) Zahlbr. forma *exsulans* (Th.Fr.) Zahlbr., *Cat. Lich. Univ.* 5 : 660 (1928)

Squamaria chrysoleuca (Sm.) Ach. var. *melanophthalma* (Ram.) Zahlbr. forma *exsulans* (Th.Fr.) in *Nytt Mag. Naturv.* 40 : 208 (1902)

Lecanora exsulans (Th.Fr.) Dodge & Baker in *Ann. Miss. Bot. Gard.* 25 : 570 (1938)

Lecanora exsulans forma *minor* Dodge in *BANZ. Antarct. Res. Exped. Rep.* 7 : 172 (1948)

Thallus composed of more or less round-lobed irregular and elongated frequently imbricated squamules $0.3-0.6\text{mm} \times 0.2-0.5\text{mm}$, light ochraceous buff to greenish-grey, in scattered colonies amongst other lichens. *Cortex* $25-30\mu$ thick. *Algal layer* up to 200μ thick, cells $6-10\mu$ diam. *Apothecia* $0.5-4.0\text{mm}$ diam., ochraceous buff, nickel green to greenish-black, concave. *Margin* concolorous with the thallus, smooth, crenulate and irregular, becoming folded into cerebriform masses. *Hymenium* $75-100\mu$ high. *Paraphyses* simple or rarely branched. *Asci* clavate $60-75 \times 10-17\mu$. *Ascospores* simple, ellipsoid, hyaline $12-15 \times 4-6\mu$.

REACTIONS: K-, C-, P-, KC+ yellowish, medulla I-, hymenium+ deep blue, epithecium HNO_3 + pale brownish red.

CHEMISTRY: Usnic acid only in G.E.

SPECIMENS EXAMINED: Clarke Peninsula, Wilkes Station, W. A. Groom, 1966 (with *Umbilicaria decussata*, MEL 26105); Clarke Peninsula, at the head of Powell Cove, B. M. Allwright, 15.i.1972 (with *Umbilicaria decussata*, MEL 1012018); Bailey Peninsula, 1.5km south of Casey Station, D. J. Bishop, 15.iii.1970 (with *Biatorella antarctica*, MEL 1012061); Bailey Peninsula, downhill to north-east of GII, R. Anderson, 27.ii.1969 (with *Usnea antarctica*, MEL 1012026); rock outcrop on the north coast of Mitchell Peninsula, due south of small island in O'Brien Bay, R. Anderson, 2.iii.1969 (MEL 1012021); Peterson Island, D. J. Luders CB72/17 (in part), 21.xi.1972 (with *Buellia frigida*, MEL 1012009); northern site, Peterson Island, R. Anderson, 5.i.1970 (MEL 1012045); Browning Peninsula, near plateau, R. Anderson, 5.i.1970 (with *Umbilicaria decussata*, MEL 1012041); eastern side, Haupt Nunataks, R. Anderson, 3.i.1970 (with *Buellia lignoides*, MEL 1012030).

DISCUSSION: This species in most instances grows in association with other lichens. The individual samples are typical and show the same variation in colour as those occurring in Mac. Robertson Land (Filson, 1966 : 50). Apothecia of those growing in direct sunlight range from deep sea-green to blackish-green, but those in shaded situations are pinkish-buff and all colour variations between the two may be found in a single colony.

The epithet *exsulans* was altered to *exulans* in Zahlbruckner, *Catalogus Lichenum Universalis* 5 : 660 and many authors have perpetuated this form of the word.

4. *Lecideia andersonii* R. Filson sp. nov. [Fig. 3.]

Species nova ex affinitate *L. phillipsianae* differt sic: apothecium grande, marginatum, nunquam hemisphaericum; hypothecium pallidiore et commutatio iodina in medulla positiva.

Thallus crustose, brownish to greyish-white, irregular, often developing below the surface of the cracks in rocks so that the

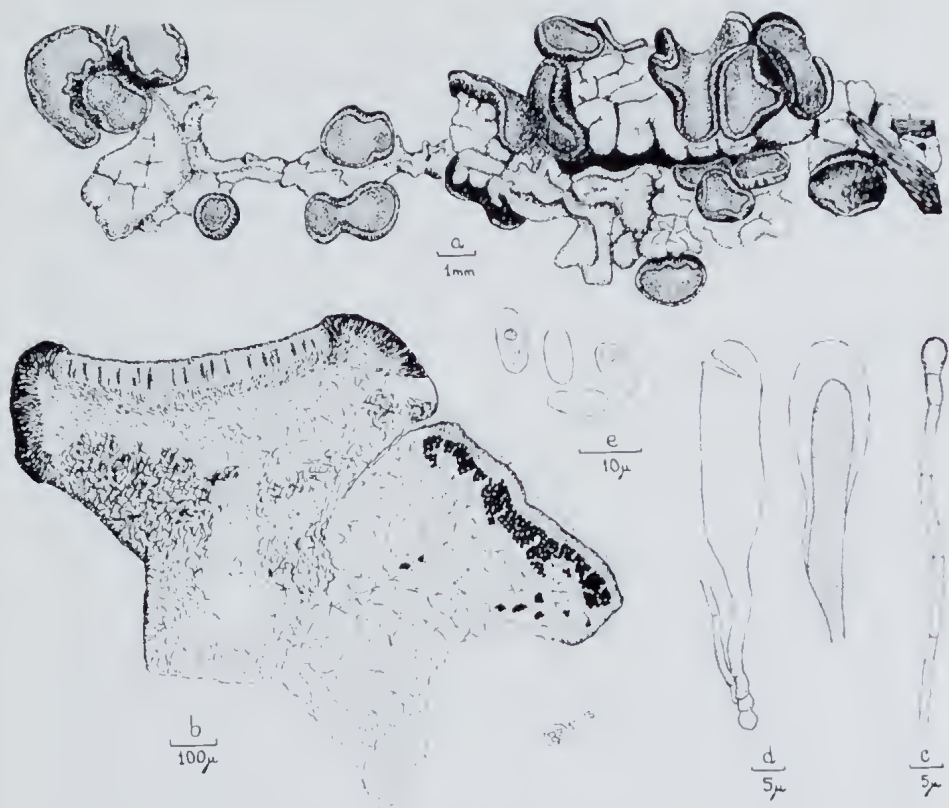


Fig. 3.—*Lecidea andersonii* R. Filson: a—portion of the TYPE specimen (MEL 1012035); b—section of an apothecium from MEL 1012074; c—e—from a crushed mount of MEL 1012035; c—a paraphysis; d—a developing and an empty ascus; e—ascospores.

apothecia appear to fill them. *Upper cortex* $10\text{--}12\mu$ thick, of blackish aeruginose cells which terminate the hyphae of the medulla and with an amorphous covering $8\text{--}10\mu$ thick. *Algal layer* $60\text{--}75\mu$ thick, composed of cells up to 15μ diam. *Medulla* closely woven, hyphae $3\text{--}5\mu$ thick. *Apothecia* black, up to 1.5mm diam. *Margin* thick, black, persistent. *Disk* flat to slightly convex, never hemispheric to subspherical. *Hypothecium* thin up to 45μ thick in the centre, pale brownish. *Hymenium* $50\text{--}60\mu$ high capped by a dark aeruginose epithecium $10\text{--}15\mu$ thick. *Paraphyses* 2μ diam. slightly expanded at the apical cell to 4μ , concrete in hymenial gel which will not separate easily in water under pressure. *Asci* 8-spored, $25\text{--}45 \times 12\mu$. *Ascospores* $9\text{--}10 \times 4\text{--}5\mu$, simple, ellipsoidal, hyaline.

REACTIONS: K—, C—, P—, KC—, I+ deep violet-purple, cortex I+ violet, HNO_3 + crimson, hypothecium I+ violet, asci I+ pale blue, epithecium HNO_3 + crimson.

SPECIMENS EXAMINED: Western side of the Haupt Nunataks, R. Anderson, 3.i.1970 (MEL 1012035—HOLOTYPE); Haupt Nunataks, D. J. Bishop, 24.x.1970 (MEL 1012074).

DISCUSSION: This *Lecidea* appears totally different from any other described from Antarctic regions. It is similar to *Lecidea phillipsiana* from the Mac.Robertson Land region but differs in the large marginate apothecia which never become hemispheric, the paler hypothecium, and in the reaction of iodine on the medulla. The author has much pleasure in naming this lichen after its first collector, Ross Anderson, glaciologist at Casey during 1969.

5. ***Buellia frigida*** Darb. in *Nat. Antarct. Exped. 1901–1904, Nat. Hist.*, 5 : 7 (1910).

Rinodina frigida (Darb.) Dodge in *BANZ. Antarct. Res. Exped. Rep.* 7 : 259 (1948)

Thallus crustose, effigurate, up to 15cm diam., variable, sometimes thick, sometimes very thin, varying in colour from white to black, sometimes cream to buff and where shaded deeply cut with cracks, the whole surface breaking up into angular areoles, marginal lobes 0.5–1.2mm long and 0.2–0.4mm wide. *Cortex* 25–40 μ thick of fastigiate hyphae capped by an upper cortex of greenish brown cells 5–7 μ diam., and up to 12 μ thick, covered by a hyaline decomposed layer 10–12 μ thick. *Algal layer* 57–75 μ thick with cells 7–15 μ diam. *Apothecia* black, dull, sometimes shining, sessile or subsessile, immersed, with the thallus forming a greyish margin. *Disk* flat, convex to hemispheric 0.6–0.8mm diam. *Medulla* of loosely woven brownish hyphae. *Hypothecium* 25–30 μ thick faintly brownish. *Hymenium* 50–100 μ high. *Paraphyses* branched or unbranched with apical cells 5 μ diam., forming a greenish-brown epithecium. *Asci* clavate 12–20 \times 35–55 μ . *Ascospores* 6–10 \times 8–15 μ , elliptical, slightly constricted or not constricted at the septum, uniseptate or rarely undivided, thin-walled, dark grey, becoming dark brown at maturity.

REACTIONS: K–, C–, P–, medulla I–, hymenium 1+ deep blue, Epithecium HNO₃+ purple-red.

SPECIMENS EXAMINED: Clarke Peninsula, Wilkes Station, K. S. White, xi.1966 (MEL 26102); Clarke Peninsula, east of Whitney Point, R. Anderson, 15.i.1970 (with *Xanthoria mawsonii*, MEL 1012053); Clarke Peninsula, near NMA/S/39, B. M. Allwright, 15.i.1972 (with *Alectoria minuscula*, MEL 1012010); Bailey Peninsula, near Rx site, D. J. Luders CB72/03, 8.xi.1972 (MEL 1011985); Bailey Peninsula, near the Receivers Hut, D. J. Luders CB72/02, 19.ix.1972 (MEL 1011996); Odbert Island, D. J. Luders CB72/09 13.xi.1972 (MEL 1011998); Peterson Island, D. J. Luders CB72/17, 21.xi.1972 (MEL 1012009); Peterson Island, northern site, R. Anderson, 5.i.1970 (MEL 1012046); Peterson Island, southern site, R. Anderson, 5.i.1970 (MEL 1012043); Browning Peninsula, near plateau, R. Anderson,

5.i.1970 (MEL 1012042); Browning Peninsula, north-eastern side, D. J. Bishop, 26.x.1970 (MEL 1012065); Browning Peninsula, western side, D. J. Bishop, 25.x.1970 (MEL 1012071).

6. *Buellia grimmiae* R. Filson in ANARE Sci. Rep. Ser. B. (II) Bot. 82: 37 (1967).

Thallus continuous, forming a crust over mosses, smooth, divided into areolae by fine black wrinkles. *Cortex* 10μ thick, blackish. *Medulla* of closely woven brownish hyphae. *Apothecia* sessile, 0.5–1.0 mm diam., at first concave becoming flat to slightly convex. *Disk* black, carbonaceous. *Margin* prominent, crenulate, black, shining. *Hypothecium* hyaline or faintly brownish $60\text{--}80\mu$ thick. *Parathecium* brownish-black. *Hymenium* up to 150μ high. *Paraphyses* simple or branched, 2μ thick, expanded at the apices to 5μ , the last 2 or 3 cells darkening forming a dark epithecium up to 20μ thick. *Asci* $60\text{--}90 \times 16\text{--}20\mu$. *Ascospores* $15\text{--}25 \times 10\text{--}12\mu$ at first grey becoming brownish at maturity.

REACTIONS: *Thallus* and *medulla* K–, C–, P–, KC–, *medulla* 1+ intense violet, *hymenium* 1+ pale blue, *epithecium* HNO_3 + purple-red.

SPECIMEN EXAMINED: Haupt Nunataks, D. J. Bishop, 24.x.1970 (MEL 1012078).

DISCUSSION: When more collections of moss cushions are gathered it is most likely that more specimens of this species will be found. The specimen from Haupt Nunataks was typical though in parts badly eroded. It formed a crust up to three centimetres in diameter over the top of a cushion of *Bryum* sp.

7. *Buellia latemarginata* Darb. in Wiss. Ergebn. schwed. Sudpölärexped., 4: 15 (1912). [Fig. 4 h–l.]

Thallus crustose, discontinuous, subeffigurate at the margins, dark grey to blackish, matt, non-sorediate. *Cortex* thin, hardly differentiated. *Algal cells* scattered throughout the areole, up to 12μ diam. *Medulla* compact. *Hypothallus* black, thin, narrow, discontinuous. *Apothecia* rare, 0.5–0.8 mm diam., black. *Margin* black, thin, disappearing at maturity. *Hypothecium* brown to dark brown. *Hymenium* up to 75μ high, hyaline with a thin, dark brown epithecium. *Paraphyses* simple or branched, apical cell expanded to 6μ . *Asci* clavate, 8-spored, $45 \times 21\mu$. *Ascospores* dark brown, ellipsoid, thinly septate, $12\text{--}15 \times 7\text{--}9\mu$, occasionally slightly curved and constricted at the septum.

REACTIONS: *Medulla* K–, C–, P–, KC–, I–, *asci* 1+ blue fading, *epithecium* HNO_3 –.

SPECIMENS EXAMINED: Clarke Peninsula at G5, R. Anderson, 15.i.1970 (MEL 1012052); Bailey Peninsula, downhill to north-east of G11, R. Anderson, 27.ii.1969 (MEL 1012028).

DISCUSSION: The author has not seen any authenticated material of this species but it agrees well with the key and descriptions in Lamb (1968: 14, 50). The specimens from our area do not show the white zone around the outermost edge of

the hypothallus as described by Lamb, but in his discussion (1968: 52) of *Lecidea actinobola* Hue, Lamb states that his specimens from Vega Island, Graham Land also lacked this feature.

8. **Buellia lignoides** R. Filson in ANARE Sci. Rep. Ser. B. (II) Bot. 82: 38 (1967).

Thallus crustose, composed of small squamules 0.5–1.0 mm diam., varying in colour from pale brownish to dark grey and black. *Hypothallus* extensive, black, confervoid, openly reticulate or sometimes more or less continuous. *Cortex* 15μ thick, of large, dark spherical cells. *Algal cells* scattered $10\text{--}15\mu$ diam. with a sheath. *Medulla* thickly woven. *Apothecia* up to 0.5 mm diam., small, immersed at first, becoming sessile, slightly flattened to subspherical, sometimes covering the whole areole, black, sometimes appearing pruinose. *Hypothecium* up to 100μ thick in the centre, hyaline or faintly tinged with brown. *Hymenium* $45\text{--}60\mu$ high including the dark epithecium, $10\text{--}15\mu$ thick. *Paraphyses* $1.5\text{--}2.0\mu$ thick, expanding into heads of 5μ diam. *Asci* $35\text{--}40\mu$, clavate with 8 spores. *Ascospores* 2-celled, $10\text{--}12 \times 6\text{--}9\mu$, thin-walled, slightly constricted at the septum, at first grey becoming brown.

REACTIONS: K–, C–, P–, KC–, I+ intense violet, hymenium I+ blue fading, epithecium HNO_3 + purple-red.

SPECIMENS EXAMINED: Western side of the Haupt Nunataks, R. Anderson, 3.i.1970 (MEL 1012037); eastern side of the Haupt Nunataks, R. Anderson, 3.i.1970 (MEL 1012030).

DISCUSSION: These two specimens from different localities on the Haupt Nunataks are macroscopically identical with the samples from Mac.Robertson Land. Internally the present collection agrees well with the type material with the one exception that the spores are slightly smaller. This species was previously collected in the Vestfold Hills, Princess Elizabeth Land, by G. W. Johnstone, and the present collections extend the range a little further around eastern Antarctica.

9. **Buellia** cf. **papillata** (Sommerf.) Tuck. *Lichens of California* 26 (1866). [Fig. 5.]

Thallus crustaceous, forming an irregular crust over mosses, eroded, thick, white or greyish-white. *Apothecia* minute, 0.2–0.5 mm diam. black, margin prominent and becoming thin but not disappearing. *Hypothecium* brown to dark brown. *Hymenium* up to 60μ high, hyaline. *Asci* $40 \times 18\mu$, 8-spored. *Ascospores* $12\text{--}18 \times 7\text{--}9\mu$, 2-celled, brown, walls and septum of equal thickness though rarely thickened at the septum.

REACTIONS: Medulla K–, C–, P–, KC–, I–, hymenium I+ blue fading, epithecium HNO_3 –.

SPECIMEN EXAMINED: Bailey Peninsula, near Rx site, D. J. Luders CB72/05c, 19.ix.1972 (MEL 1011989).

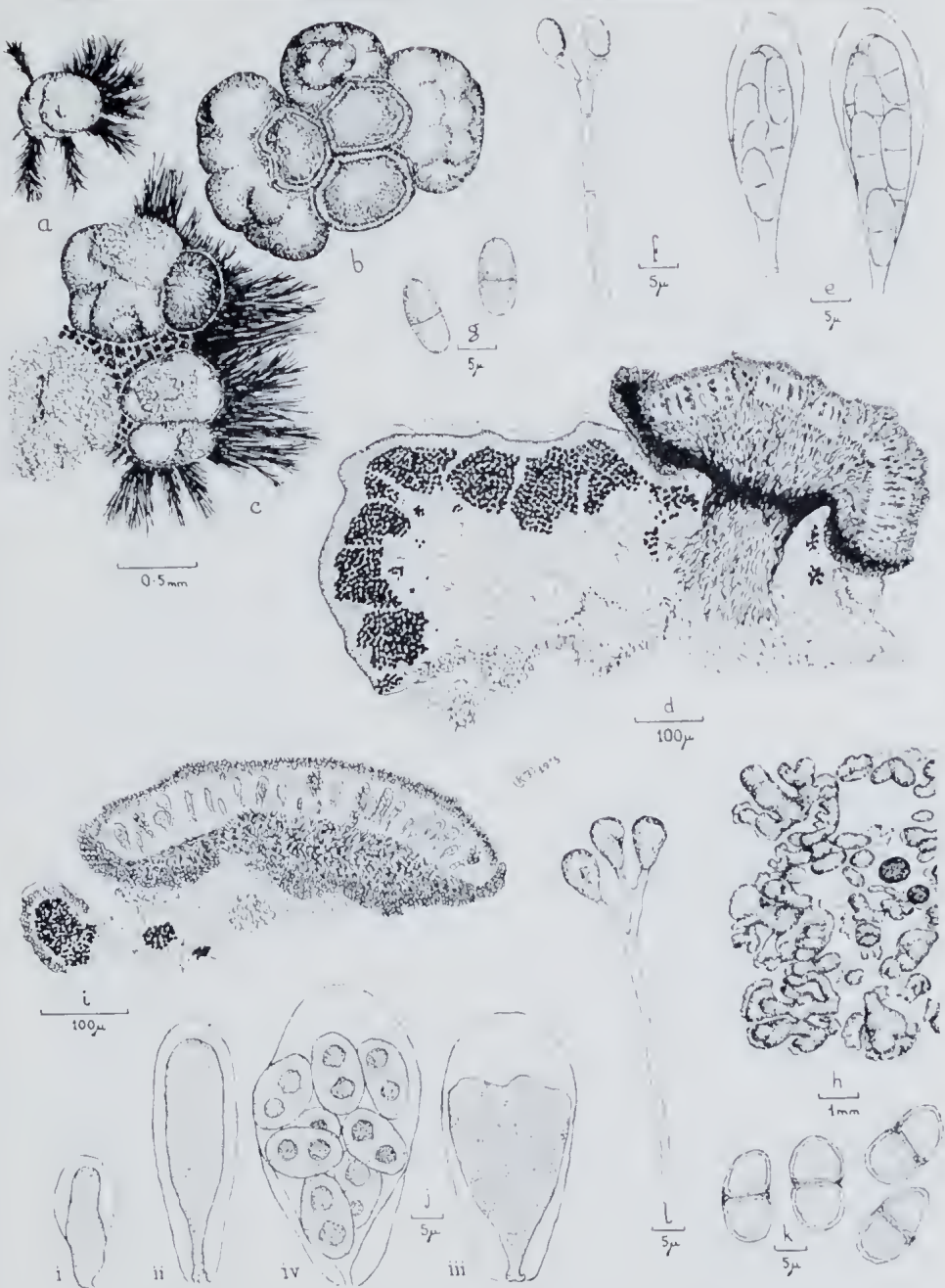


Fig. 4.—a–g—*Buellia soredians* R. Filson (from the TYPE specimen MEL 1012012); a–c—habitat details: a—young areolae on dendritic hypothallus; b—apothecia and areolae without visible hypothallus; c—sorediose areolae one with apothecia on radiate hypothallus; d—section of apothecium; e—developing asci; f—a branched paraphysis; g—ascospores. h–l—*Buellia latemarginata* Darb; h—habitat detail from MEL 1012028 showing areolae and apothecia; i—section of an apothecium; j—stages in development of asci (in KOH); k—ascospores; l—a branched paraphysis.

DISCUSSION: This specimen appears very similar to *B. grimmiae* but differs in having smaller apothecia, smaller spores, and a negative reaction of the medulla with iodine. According to the key in Lamb (1968: 14) it would be referred to *B. punctata* (Hoffm.) Mass. or *B. papillata* (Sommerf.) Tuck. It is similar to *B. punctata* in most of its measurements, apothecia, asci, and spores but differs in its general appearance. *B. punctata* is described as having a very thin effuse thallus, and certainly specimens found in Australia agree with this. On the other hand *B. papillata* is described as being thick, nodulose-verrucose. Macroscopically our material fits the latter description. The

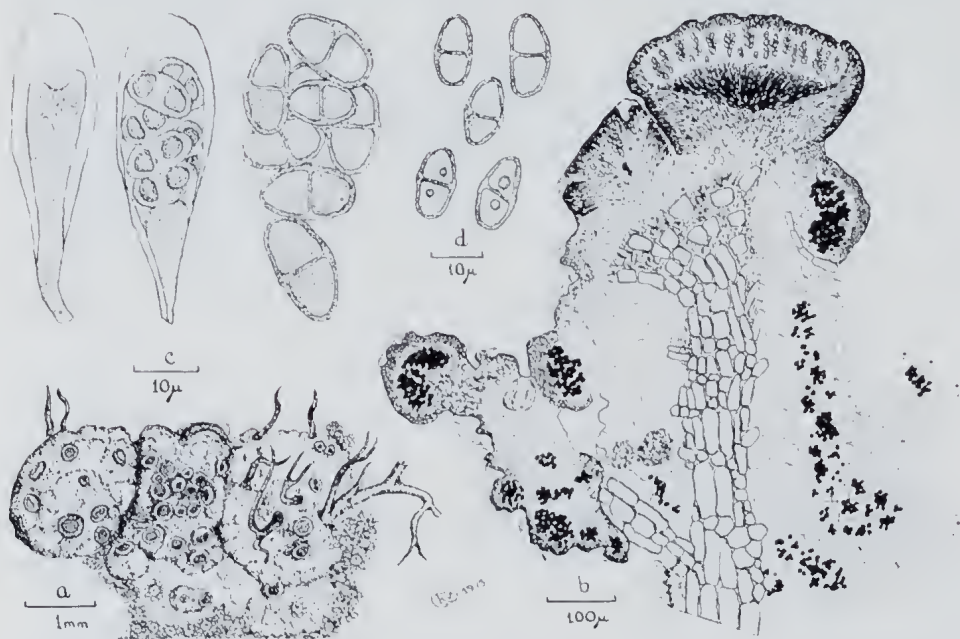


Fig. 5—*Buellia cf. papillata* (Sommerf.) Tuck.: a—habitat details of MEL 1011989 growing amongst mosses; b—section of apothecia and areolae on a moss; c—two stages in the development of an ascus and a cluster of spores from the hymenium; d—ascospores showing thickening at the septa.

spores, although slightly smaller than those given for *B. papillata*, agree well with the figure in Lynge (1928: pl. IV, f. 15–17) where in fig. 17, he shows a slight thickening at the septum. More specimens must be collected before we can be certain if this is a modification of either of the aforementioned species or is in fact a separate entity.

10. *Buellia soredians* R. Filson sp. nov. [Fig. 4 a–g.]

Thallus crustaceus, squamulae pulvinatae, hemisphaericae, laeves, nunc soralis erosio concavis nunc omnino sorediosus atque pulvinos hemisphaericos formantibus.

Thallus crustose, composed of squamules up to 1.5mm diam., pulvinate, hemispherical, pale brown to dark isabelline in exposed

positions, smooth, sometimes with an eroded concave soralia, sometimes completely sorediate and forming pulvinate clumps up to 4mm diam. Cortex $15\text{--}20\mu$ thick. Algal layer discontinuous up to 120μ thick. Algal cells up to 15μ diam. Medulla compact. Hypothallus well developed, black, carbonaceous, aeruginose at the extreme margin, at first dendritic becoming continuous at maturity. Apothecia $0.3\text{--}0.7\text{mm}$, sessile, black. Margin prominent. Hypothecium thick, dark brown. Hymenium up to 60μ high, brownish. Epithecium up to 10μ thick, dark brown. Paraphyses 2μ thick, branched, apical cell expanded to 4μ diam. Asci $35 \times 12\mu$ with 8 spores. Ascospores $4\text{--}6 \times 9\text{--}10\mu$, thin walled, septate, not constricted at the septum, pale grey to brown.

REACTIONS: Medulla K-, C-, P-, KC-, I-, hymenium I+ blue, epithecium HNO_3 -, hypothallus HNO_3 + purple-red.

SPECIMEN EXAMINED: Clarke Peninsula, near NMA/S/39, B. M. Allwright, 15.i.1972 (MEL 1012012—HOLOTYPE).

DISCUSSION: This new species is distinctive because it is the first sorediose *Buellia* recorded from the Antarctic continent. Although as yet known from only one collection, the material is ample. Unfortunately there were only four apothecia on the specimen and one was sectioned for the above descriptions.

11. *Physcia caesia* (Hoffm.) Hampe in Fürnr. Naturh. Topogr. Regensburg. 2: 250 (1839).

Thallus of narrow, branching, imbricate lobes, $140\text{--}260\mu$ thick and $0.5\text{--}3.0\text{mm}$ broad, smooth becoming verrucose, light grey to grey-brown, sorediose. Underside of *thallus* buff, darkening to nearly black with scattered tufts of branched rhizines, varying from light buff to dark brown. Cortex $15\text{--}20\mu$ ($\sim 70\mu$) thick. Algal layer $50\text{--}80\mu$ thick, sometimes extending to the top of the cortex and occasionally with odd cells embedded in the medulla. Algal cells up to 20μ diam. Medulla up to 25μ thick of hyphae not too tightly packed hyaline or faintly tinged with brown. Lower cortex $25\text{--}60\mu$ thick, of compactly woven thick-walled hyphae, hyaline with the outer 10μ darkening, rhizines outgrowing from these hyphae. Rhizines formed of compactly woven, thick walled hyphae $50\text{--}100\mu$ diam., cells elongated, $7\text{--}15 \times 4\mu$. Apothecia not seen.

REACTIONS: *Thallus* K+ yellow, C-, P+ pale yellow, medulla K+ yellow, P-.

SPECIMEN EXAMINED: Clarke Peninsula, Wilkes Station, K. S. White, xi. 1966 (with *Protoblastenia citrina* MEL 26104).

DISCUSSION: The specimens here are a little more brownish in appearance than in the typical form but the author considers them to be referable to this species because of the shape of the

lobes and the formation of the soredia. Possibly this colour may be attributed to the locality near melt pools and to the degree of exposure.

12. *Rinodina archaeoides* H.Mag. *Medd. Fran Göteborgs Bot. Trädg.* 17: 278 (1947).

Thallus subsquamulose, covering areas up to 12cm in diam., spreading over mosses or amongst loose gravels, olive brown to dark brown, with a thick amorphous layer covering the outside sometimes giving the whole plant a white gelatinous appearance. *Apothecia* abundant, irregularly shaped by pressure, up to 1.0mm in diam. *Margin* crenulate, concolorous with the thallus or slightly lighter. *Disk* dark brown to black. *Cortex* 25–40 μ thick, continuous and of the same structure as the thallus. *Algal cells* up to 12 μ diam. continuing under the hymenium. *Hypothecium* thin, hyaline. *Hymenium* 80–100 μ high. *Paraphyses* thin, branched, apical cell slightly expanded. *Asci* 60–90 \times 16–20 μ , clavate 8-spored. *Ascospores* 16–21 \times 8–9 μ , 2-celled, dark brown.

REACTIONS: K–, C–, P–, KC–, medulla I–, Hymenium I–, hypothecium I+ pale blue, epithecium HNO₃–.

SPECIMENS EXAMINED: Bailey Peninsula, west of Casey Station near nest site S16, D. J. Luders CB72/15b, 7.xii.1972 (MEL 1011992); Browning Peninsula, D. J. Bishop, 26.x.1970 (with *Caloplaca athallina* MEL 1012070).

DISCUSSION: Amongst the collections brought back from the study area there are very few collections of moss cushions thus accounting for the lack of specimens of this lichen. The samples here cited are typical and agree in every detail with other collections examined by the author from elsewhere in Antarctica.

13. *Rinodina petermannii* (Hue) Darb. in *Brit. Antarct. Terra Nova Exped. 1901–1904 Nat. Hist. Rep. Bot.* 3: 61 (1923). [Fig. 6 g–j.]

Lecanora petermannii Hue, in *Deux. Exped. Antarct. Francaise 1908–1910* 96 (1915).

Thallus crustose, lobate-effigurate at the margins, centre parts pulvinate, verrucose, fawn to pale brown in sheltered places, brownish-to blackish-brown in exposed places, matt, often pruinose, up to 8mm thick in the centre. *Cortex* up to 30 μ thick. *Medulla* loosely compacted of hyphae up to 5 μ diam. *Apothecia* 0.3–1.0mm diam. *Margin* prominent, concolorous with the thallus, persistent. *Disk* concave, brownish-black to black, matt, sometimes pruinose. *Hypothecium* hyaline, up to 75 μ thick in the centre. *Hymenium* up to 90 μ high. *Paraphyses* simple, apical cell reddish-brown, expanded to 4–5 μ . *Asci* 50–80 \times 21–27 μ , 8-spored. *Ascospores* 16–22 \times 9–10 μ brown, 2-celled, sometimes slightly constricted at the septum.

REACTIONS: K-, C-, P-, KC-, I-, hymenium I + blue fading in the upper parts but remaining constant in the lower.

SPECIMEN EXAMINED: Peterson Island, R. Anderson, 5.i.1970 (MEL 1012047).

DISCUSSION: The single specimen in this collection represents the only sample of *Rinodina* found growing on rock in the region. Unfortunately it was removed from the rock and only the central parts of the thallus remain, but these are clearly lobate and agree exactly with the description and figures in Lamb (1968: 30, plate XIV).

14. *Rinodina turfacea* (Wahlenb.) Körb., Syst. Lich. Germ. 123 (1855). [Fig. 6 a-f.]

Lichen turfaceus Wahlenb. *Flora Lapponica* 408 (1812).

Thallus granulose or verruculose, growing over the tops of mosses or amongst fruticose lichens, drab brown, matt. *Apothecia* abundant, up to 1.5 mm diam. *Margin* entire or crenulate, concolorous with the thallus. *Disk* brownish-black, matt. *Hypothecium* hyaline up to 30μ thick. *Hymenium* hyaline, up to 90μ high, with a reddish-brown epithecium. *Paraphyses* branched, slightly expanded at the tips. *Asci* 5-8-spored, $65-75 \times 21-30\mu$. *Ascospores* $24-33 \times 12-15\mu$, 2-celled, dark brown.

REACTIONS: K-, C-, P-, I-, hymenium I + blue fading, hypothecium I + violet becoming dark blue, epithecium HNO_3 -.

SPECIMENS EXAMINED: Clarke Peninsula, Wilkes Station, W. A. Groom, 1966 (with *Usnea antarctica* MEL 26100); Clarke Peninsula, near NMA/S/39, B. M. Allwright, 15.i.1972 (MEL 1012011); rock outcrop on the north coast of Mitchell Peninsula due south of small island in O'Brien Bay, R. Anderson, 2.iii.1969 (with *Protoblastenia citrina* MEL 1012023).

DISCUSSION: The specimens from Clarke Peninsula were all growing in association with other lichens. One sample had almost covered a rosette of *Alectoria minuscula* whilst other rosettes had numerous colonies amongst their filaments. Another sample had encrusted the holdfasts and lower parts of several thalli of *Usnea antarctica*. The specimens from Mitchell Peninsula are typical, growing over mosses and fine gravels.

None of the specimens examined by the author showed any reaction with iodine on the apothecial cortex. Variable reports have been discussed: Magnusson (1947: 203, 263) says that it has a faint but distinct blue coloration, Poelt (1969: 591) also gives the cortex as blue with iodine but M. Lamb (1968: 63) reports a faint, and apparently inconsistent fleeting reaction in some specimens.

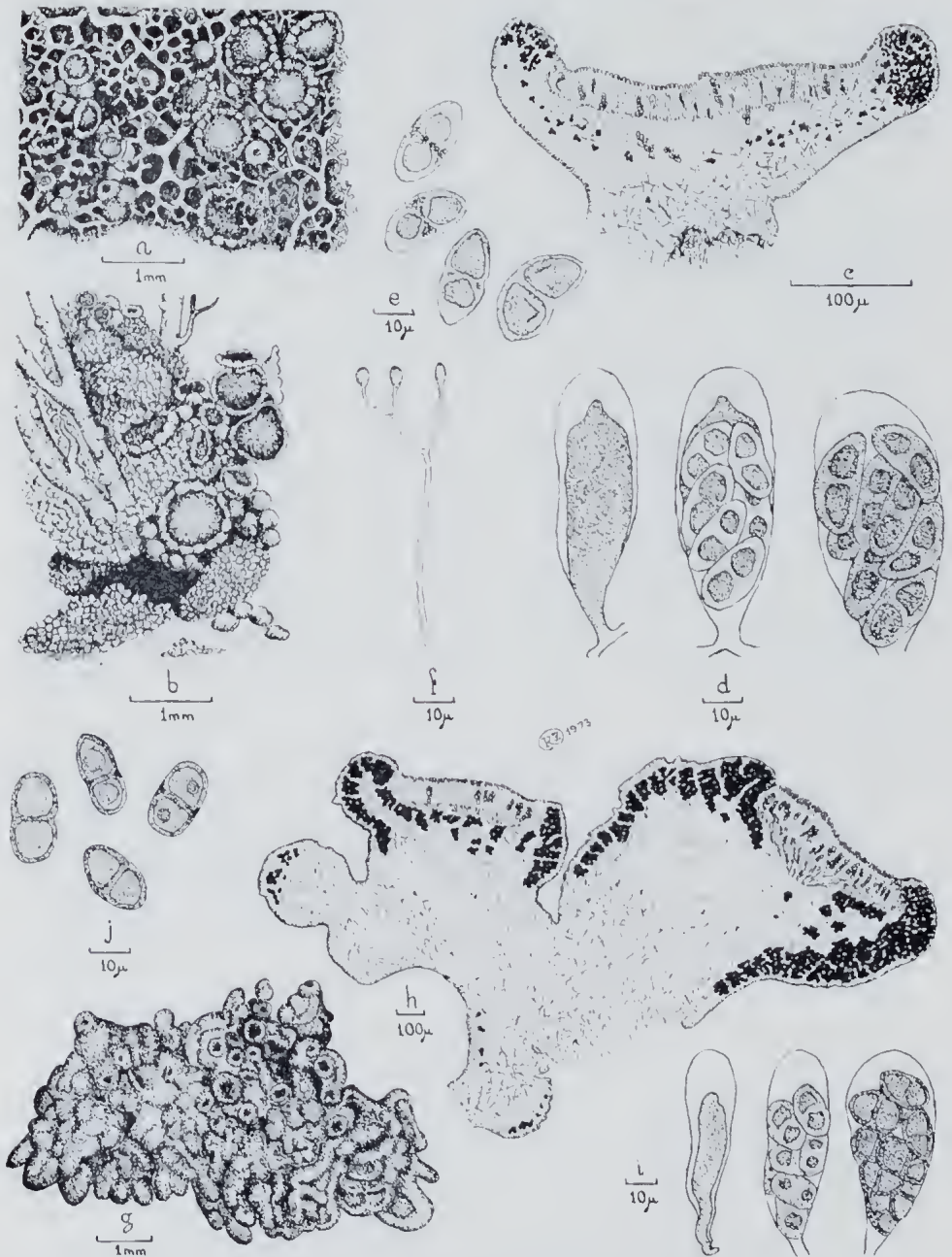


Fig. 6—a–f: *Rinodina turfacea* (Wahlb.) Korb.: a—habitat detail from MEL 1012011 showing thallus growing on *Alectoria minuscula*; b—habitat showing thallus growing with *Protoblastenia citrina* at the base of *Usnea antarctica*; c–f: from MEL 1012011; c—section of apothecia; d—stages in development of asci; e—ascospores; f—branched paraphysis; g–j—*Rinodina petermannii* (Hue) Darb; g—habitat detail from MEL 1012047; h—section of apothecia; i—development of the ascus; j—ascospores.

15. *Caloplaca athallina* Darb. in Wiss. Ergebn. Schwed. Südpolar-Exped. 1901-1903 4 (11): 9 (1912). [Fig. 7.]

Pyrenodesmia athallina (Darb.) Dodge & Baker in Ann. Miss. Bot. Gard. 25: 621 (1938).

Thallus forming patches up to 2cm diam. over mosses, not well developed, almost covered by crowded apothecia, grey to yellowish-grey. *Cortex* discontinuous, formed by dark outer cells up to 30μ thick, capped by a hyaline amorphous layer up to 8μ thick. *Algal layer* continuous, up to 20μ thick, consisting of cells up to 18μ diam. *Apothecia* numerous, round, sometimes deformed by mutual pressure, 0.3-0.75mm diam. *Disk* flame-orange, concave to slightly hemispheric. *Margin* slightly raised at maturity, concolorous with the disk. *Hypothecium* thin hya-



Fig. 7—*Caloplaca athallina* Darb.: a-habitat detail from MEL 1011991 showing crowded apothecia growing over mosses; b-section of apothecia; c-branched paraphysis; d-development of asci; e-ascospores.

line. *Hymenium* hyaline up to 90μ high. *Paraphyses* simple or branched 2μ thick; apical cell expanded to 6μ , thickly encrusted with yellowish crystals. *Asci* 8-spored, $60 \times 21\mu$. *Ascospores* $15-16 \times 9-10\mu$, hyaline, polaribilocular.

REACTIONS: Cortex K+ purple, medulla K—, epithecium K+ red, hymenium 1+ blue, medulla I—.

SPECIMENS EXAMINED: Bailey Peninsula west of Casey Station near nest Nr. 16, D. J. Luders CB72/15a, 7.xii.1972 (MEL 1011991); Browning Peninsula, D. J. Bishop, 25.x.1970 (MEL 1012070).

DISCUSSION: The author has not examined the type material of this species but specimens from the Australian Antarctic

Territory agree with Darbishire's description and figure. The spore sizes given by Darbishire are slightly smaller than those in the present material but they are still considered to be within an acceptable range.

16. *Caloplaca citrina* (Hoffm.) Th.Fr. in *Nova Acta Sci. Upsal.*, Ser. 3, 3 : 281 (1861).

Verrucaria citrina Hoffm. *Deutschl. Flora* 198 (1796).

Pyrenodesmia mawsonii Dodge in *BANZ. Antarct. Res. Exped. Rep.* 7 : 232 (1948).

Thallus squamulose, up to 1cm diam., growing over the tops of mosses or in pulvinate clumps on rock. *Squamules* up to 1mm diam., florida gold to yellow-orange, smooth, becoming sorediose until squamule is completely enveloped in yellow-green soredia. *Cortex* up to 35μ thick. *Algal cells* up to 20μ diam., scattered throughout the medulla. *Medulla* of thin-walled hyphae 4μ diam. *Apothecia* not seen.

REACTIONS: *Thallus* K+ purple, medulla K—, C—, P—.

SPECIMENS EXAMINED: Bailey Peninsula, Casey Station near transmitter hut, D. J. Bishop, 24.ii.1970 (MEL 1012056); Bailey Peninsula, near Rx site, D. J. Luders CB72/05b, 8.xi.1972 (MEL 1011988); Peterson Island, D. J. Luders CB72/14e, 21.xi.1972 (MEL 1012008).

17. *Caloplaca elegans* (Link.) Th.Fr. var. *pulvinata* (Dodge & Baker) J. Murray in *Trans. Roy. Soc. NZ.* 2 : 64 (1963).

Polycauliona pulvinata Dodge & Baker in *Ann. Miss. Bot. Gard.* 25 : 628 (1938).

Thallus bright orange-red to yellow-chrome in shaded places, up to 11cm in diam., with radiating appressed or imbricate lobes, lobes hollow or filled with loosely woven hyaline thin-walled hyphae, esorediose, sometimes forming clumps up to 2cm high. *Algal layer* evenly distributed around the lobes and varying in thickness up to 100μ . *Algal cells* $8-10\mu$ diam. *Lower cortex* 25μ thick, consisting of subspherical cells $5-7\mu$ diam., the lower $5-10\mu$, yellowish. *Apothecia* up to 2mm diam., at first concave, later becoming flat or moderately convex. *Margin* smooth or slightly crenulate, concolorous with the thallus. *Disk* deep orange-red. *Hymenium* $60-75\mu$ high. *Asci* $50-65 \times 14-20\mu$, clavate, becoming long-ellipsoid. *Ascospores* ellipsoid, hyaline, polaribilocular, canal mostly present in mature spores, very variable in size, $7-10 \times 11-16\mu$.

REACTIONS: *Thallus* K+ purple, medulla K—, I—, hymenium I+ deep blue, epitecium K+ red-purple.

SPECIMENS EXAMINED: Peterson Island, southern site, R. Anderson, 5.i.1970 (MEL 1012044); Peterson Island, D. J. Luders CB72/16, 21.xi.1972 (MEL 1012003).

DISCUSSION: This is a coastal species and it is expected to occur on the adjacent Browning Peninsula and on Odbert Island.

18. *Protoblastenia citrina* Dodge in BANZ. Antarct. Res. Exped. Rep. 7: 222 (1948).

Thallus granular, composed of spherical granules in clumps up to 5mm diam., lemon-yellow to yellow-orange, granules up to 100μ diam., ecorticate. *Algal cells* $8-12\mu$ diam., scattered throughout the medulla. *Medulla* loosely packed, containing granules. *Apothecia* up to 0.4mm diam. concolorous with the thallus. *Disk* convex, yellow-orange. *Margin* thin, not elevated. *Hymenium* up to 65μ high. *Paraphyses* slender, 2μ diam., simple or branched, tips slightly thickened and encrusted with yellowish crystals. *Asci* clavate, $50-65 \times 12-16\mu$. *Ascospores* unicellular, hyaline, ellipsoidal, $18 \times 6\mu$.

REACTIONS: K-, C-, P-, medulla I-, hymenium and hypothecium I+ pale bluish-green fading.

SPECIMENS EXAMINED: Clarke Peninsula, 800m north-east of old Wilkes Station, B. M. Allwright, 15.i.1972 (MEL 1012017); Clarke Peninsula, to the east of Whitney Point, R. Anderson, 15.i.1970 (with *Xanthoria mawsonii*, MEL 1012053); Bailey Peninsula, near Rx site, D. J. Luders CB72/06, 8.xi.1972 (MEL 1011986); rock outcrop on the north coast of Mitchell Peninsula, due south of small island in O'Brien Bay, R. Anderson, 2.iii.1969 (MEL 1012023); Odbert Island, D. J. Luders CB72/08 (in part), 13.xi.1972 (with *Buellia frigida*, MEL 1011999); Peterson Island, D. J. Luders CB72/13, 21.xi.1972 (MEL 1012002); Browning Peninsula, D. J. Bishop, 26.x.1970 (MEL 1012068).

19. *Xanthoria mawsonii* Dodge in BANZ. Antarct. Res. Exped. Rep. 7: 236 (1948).

Thallus in pulvinate tufts up to 2cm diam. and up to 1cm high, lobes irregularly palmate, 0.1-1.0mm wide and up to 2mm long, florida gold in exposed places, greenish buff in sheltered positions, attached to the substratum by small holdfasts, with or without rhizines. *Upper cortex* up to 20μ thick, outer 8μ heavily-encrusted with yellowish-brown crystals. *Algal layer* discontinuous and consisting of cells up to 25μ diam., scattered or in small colonies throughout the medulla. *Medulla* of loosely-woven branched and anastomosing hyphae. *Lower cortex* similar in thickness and structure to the upper cortex. *Apothecia* not seen.

REACTIONS: *Thallus* K+ purple.

SPECIMENS EXAMINED: Clarke Peninsula, Wilkes Station, K. S. White, xi. 1966 (MEL 26106); Clarke Peninsula, to the east of Whitney Point, R. Anderson, 15.i.1970 (MEL 1012053); Odbert Island, D. J. Luders CB72/12, 13.xi.1972 (MEL 1012000).

20. *Umbilicaria decussata* (Vill.) Zahlbr. *Cat. Lich. Univ.* 8: 490 (1942). [Fig. 8 a-c.]

Lichen decussatus Vill. *Hist. Plant. Dauphine* 3: 964 (1789).
Omphalodiscus decussatus (Vill.) Schol. in *Nyt. Mag. Naturvid.* 75: 23 (1934).

Thallus monophyllous, sometimes polyphyllous, 0.5–5.0 cm diam., variable, rugose to cerebriform and deeply folded, rugi elevated into fine reticulate patterns or broadly or laterally compressed into strongly formed ridges. *Upper surface* rimose, areolate, pruinose, dull, varying in colour from light grey olive, wood brown to grey and black. *Lower surface* brown to sooty black, dull, without rhizines. *Decomposed layer* discontinuous, hyaline, up to 25μ thick. *Upper cortex* 20–40 μ thick, continuous. *Algal cells* 8–12 μ diam. *Medulla* of thick walled, septate, branched hyphae 6 μ diam., very loosely packed. *Lower cortex* 40–115 μ thick, with outermost layer dark brown. *Apothecia* very rare, 0.3–1.4 mm diam., black, carbonaceous, adnate to the thallus. *Disk* flat, sometimes fissured, older specimens appearing gyrose. *Hypothecium* dark brown. *Hymenium* up to 70 μ high, pale brown. *Paraphyses* simple or branched, apical cell slightly expanded. *Asci* c. $45 \times 18\mu$. *Ascospores* hyaline, simple, c. $9 \times 7\mu$.

REACTIONS: K–, C–, P–, hymenium 1–, asci outer sheath I + blue, asci inner sheath and contents I + red, medulla 1–.

SPECIMENS EXAMINED: Clarke Peninsula, Wilkes Station, W. A. Groom, 1966 (MEL 26105); Clarke Peninsula, near NMA/S/39, B. M. Allwright, 15.i.1972 (MEL 1012015); Clarke Peninsula, at the head of Powell Cove, B. M. Allwright, 15.i.1972 (MEL 1012018); Clarke Peninsula, at G5, R. Anderson, 15.i.1972 (MEL 1012050); Clarke Peninsula, old transmitter hut site, D. J. Bishop, 11.ix.1970 (MEL 1012062); Bailey Peninsula, near Receivers Hut, D. J. Luders CB72/01, 19.ix.1972 (MEL 1011995); Bailey Peninsula, downhill to the north-east of G11, R. Anderson, 2.iii.1969 (MEL 1012027); Bailey Peninsula, south-west corner, D. J. Bishop, 19.iii.1970 (MEL 1012081); rock outcrop on the north coast of Mitchell Peninsula due south of small island in O'Brien Bay, R. Anderson 2.iii.1969 (MEL 1012022); Mitchell Peninsula, D. J. Bishop, 15.iv.1970 (MEL 1012064); Browning Peninsula, near plateau, R. Anderson, 5.i.1970 (MEL 1012041); Alexander Nunataks, northern outcrop, D. J. Bishop, 24.x.1970 (MEL 1012063); eastern side of Haupt Nunataks, R. Anderson, 3.i.1970 (MEL 1012033); western side of Haupt Nunataks, R. Anderson, 3.i.1970 (MEL 1012038); Haupt Nunataks, D. J. Bishop, 24.x.1970 (MEL 1012076).

DISCUSSION: The specimens from Clarke Peninsula, at the head of Powell Cove, are the first fertile specimens that the author has seen from the Antarctic Continent. On the sample

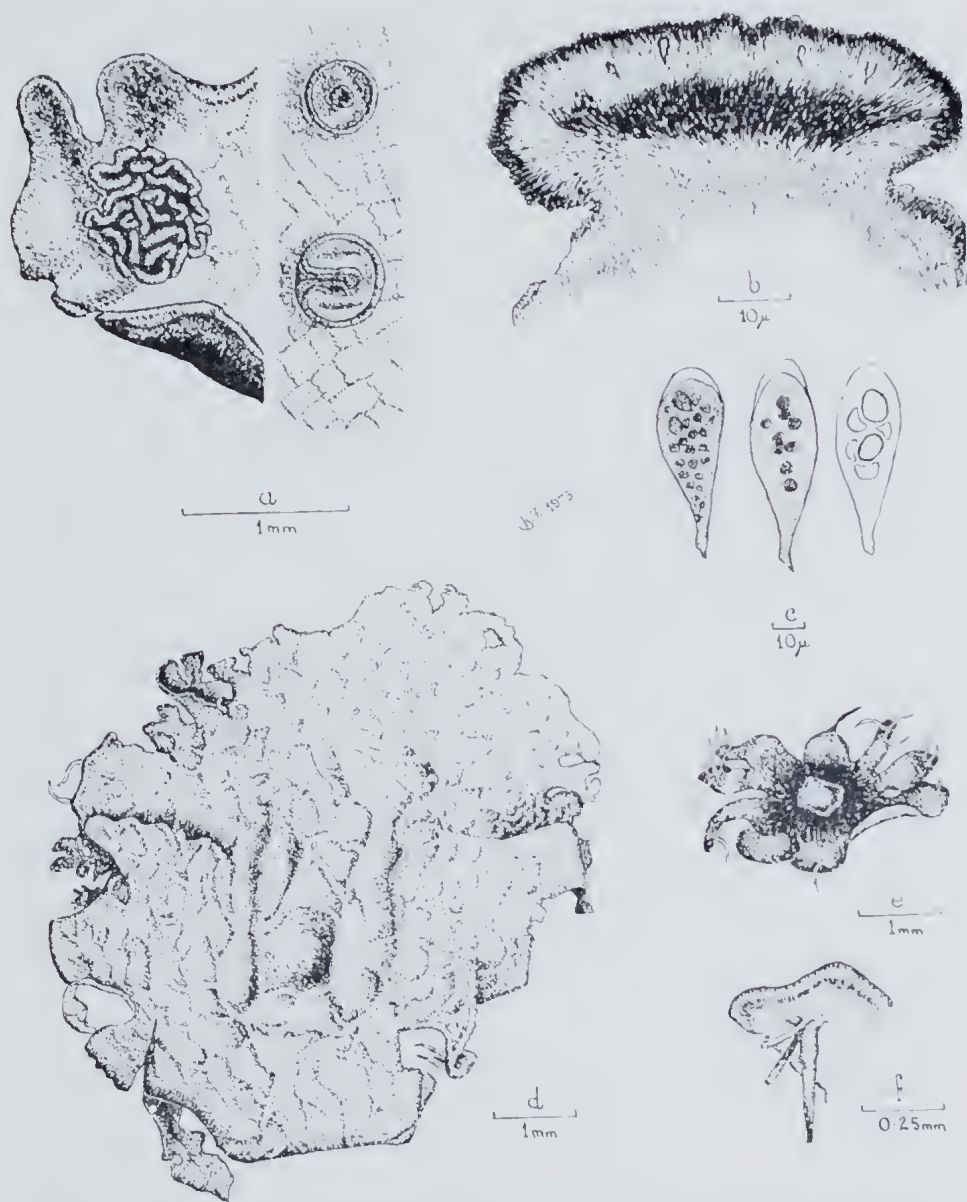


Fig. 8—*a-c-Umbilicaria decussata* (Vill.) Zahlbr.: *a*—apothecia on separate thalli from MEL 1012018; *b*—section of apothecia; *c*—three asci from the hymenium in Melzer's reagent. *d-f-Umbilicaria cristata* Dodge and Baker: *d*—thallus from MEL 1012077; *e*—underside of thallus and sparse rhizines and a detail of rhizines.

were twenty-five thalli and of these only three were fertile. One thallus contained eight, one six and the other two apothecia. Three apothecia were sectioned but it was not possible to separate the hymenium sufficiently to accurately measure the asci and spores. However the measurements that were obtained compared favourably with those obtained from Australian specimens. The reactions on the asci with iodine (Melzers reagent) were the same in both specimens from Australia and the Antarctic—the outer sheath stained blue whilst the inner sac and spores took up the iodine colour.

21. **Umbilicaria cristata** Dodge & Baker in *Ann. Miss. Bot. Gard.* 25: 565 (1938). [Fig. 8 d-e.]

Thallus small, up to 8mm diam., monophyllous, smooth or rugose, margin entire or deeply lacerate with tufts of rhizinae; upper surface dull and varying in colour from wood brown to blackish; lower surface dark brown lighter towards the margins. *Apothecia* not seen.

SPECIMEN EXAMINED: Haupt Nunataks, D. J. Bishop, 24.x.1970 (MEL 1012077).

DISCUSSION: This species could have been overlooked by inexperienced collectors because the seven thalli represented in this collection were growing in very close association with *Umbilicaria decussata*. Owing to the small number of thalli none were sectioned nor chemically examined. The specimens agree with the type description in Dodge (1938) and also agree with the description and key in Llano (1950, pp. 113, 118). Llano gives thalline measurements as up to 3cm diam. The material from the study area is much smaller than this but further collecting may yield larger examples.

22. **Alectoria minuscula** (Nyl. ex Arnold) Degel. in *Nytt Mag. Naturv.* 78: 286 (1938).

Thallus forming intricately branched, dense, flat rosettes up to 3cm diam., sometimes radiating, sometimes completely filling cracks between rocks, the filaments sometimes tend to fuse together [forma *congesta*] and sometimes form large cerebriform, vernicose masses [forma *crustacea*]. *Filaments* up to 0.2mm diam. varying in colour from isabelline to black, from sooty to glossy. *Cortex* 20 μ thick consisting of longitudinal hyphae, outermost 5 μ greenish-brown. *Medulla* of loosely-woven hyphae with numerous air spaces. *Algal colonies* scattered mostly immediately next to the cortex. *Algal cells* 10–12 μ diam., with a gelatinous sheath. *Apothecia* not seen.

REACTIONS: K–, C–, P–.

SPECIMENS EXAMINED: Clarke Peninsula, Wilkes Station, W. A. Groom, 1966 (MEL 26103); Clarke Peninsula, near NMA/S/39, B. M. Allwright, 15.i.1972 (MEL 1012010); Clarke Peninsula, at G5. R. Anderson, 15.i.1970 (MEL 1012051); Bailey

Peninsula downhill to the north-east of G11, R. Anderson, 2.iii.1969 (MEL 1012029); western face of the Bailey Peninsula D. J. Luders CB72/04, 19.ix.1972 (MEL 1011997); Bailey Peninsula near the Casey Station water supply, D. J. Bishop, 24.x.1970 (MEL 1012080); rock outcrop on the north coast of the Mitchell Peninsula, due south of small island in O'Brien Bay, R. Anderson, 2.iii.1969 (MEL 1012020); Browning Peninsula, near plateau, R. Anderson, 5.i.1970 (MEL 1012040); western side of Haupt Nunataks, R. Anderson, 3.i.1970 (MEL 1012036); eastern side of Haupt Nunataks, R. Anderson, 3.i.1970 (MEL 1012032); Haupt Nunataks, D. J. Bishop, 24.x.1970 (MEL 1012072).

23. *Alectoria pubescens* (L.) Howe jr. Class. Fam. Usneaceae 23 (1912). [Fig. 9.]

Thallus prostrate, forming a low felted mat. *Filaments* terete, thread-like, isabelline in the shade, brownish to black in exposed positions. *Cortex* up to 35μ thick of longitudinal hyphae. *Medulla* loosely woven. *Algal colonies* scattered, mostly next to the cortex, cells up to 15μ diam. *Apothecia* not seen.

REACTIONS: K-, C-, P-, KC-.

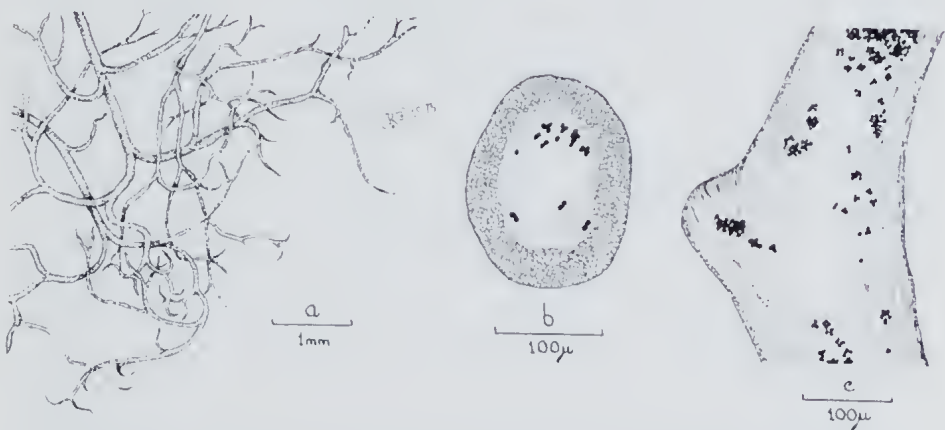


Fig. 9—*Alectoria pubescens* (L.) Howe jr.: a—portion of MEL 1012019; b—cross section of thallus; c—longitudinal section of thallus.

SPECIMEN EXAMINED: Rock outcrop on north coast of Mitchell Peninsula, due south of small island in O'Brien Bay, R. Anderson, 2.iii.1969 (MEL 1012019).

DISCUSSION: Surprisingly this is the first record of the occurrence of this species in this sector of the Antarctic Continent, but it has a wide distribution in East and West Graham Land (Lamb, 1964 : 27). The specimen cited here was growing on an erratic rock with *Alectoria minuscula*.

24. *Usnea acromelana* Stirt. in *Trans. Proc. NZ. Inst.*, 30 : 388 (1898). [Fig. 10.]

Thalli tufted, many arising from a common basal holdfast, up to 3cm tall, sparingly branched, rigid, lower parts smooth pale yellow-green, up to 1.5mm thick, upper branches black or with black bands, smooth, shining, soresiose. *Soredia* pulvinate to subglobose. *Cortex* irregular, 45–120 μ thick. *Algal cells* up to 10 μ diam., mostly in colonies next to the cortex. *Medulla* up to 120 μ thick, loosely packed with many air spaces. *Axis* solid, up to 500 μ thick in the thicker main branches, composed of longitudinal congrutinate hyphae. *Apothecia* not seen.

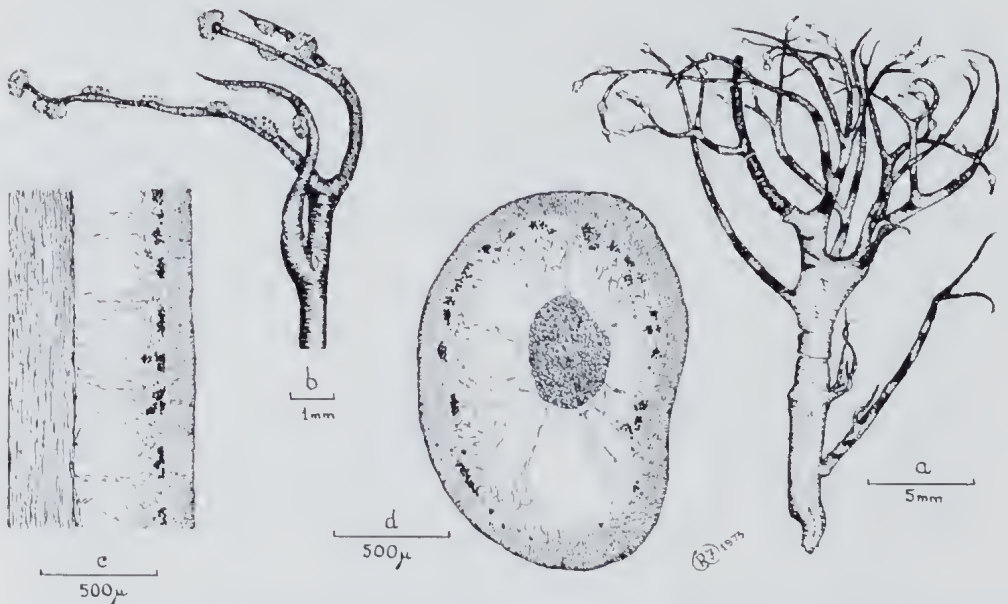


Fig. 10—*Usnea acromelana* Stirt.: a—portion of tuft showing a single branch of MEL 1012059; b—an ultimate branch showing pulvinate soralia; c—longitudinal section of thallus; d—cross section of thallus.

REACTION: K–, C–, P–, KC–.

CHEMISTRY: The specimens from the study area all occur in the inactive phase. Usnic acid was the only constituent demonstrated.

SPECIMENS EXAMINED: Bailey Peninsula, downhill to north G11, R. Anderson, 27.ii.1969 (MEL 1012025); Bailey Peninsula, near transmitter hut, D. J. Bishop, 24.ii.1970 (MEL 1012059); Bailey Peninsula, south-west corner, D. J. Bishop, 19.iii.1970 (with *Umbilicaria decussata*, MEL 1012081); Bailey Peninsula near Rx site, D. J. Luders CB72/07a, 8.xi.1972 (MEL 1011983).

DISCUSSION: This species appears to be confined to the Bailey Peninsula where it is widely distributed. In most cases it was in association with *Usnea antarctica* so it is possible that it may have been overlooked in other localities.

25. *Usnea antarctica* Du Rietz in *Svensk. Bot. Tidskr.* 20 : 93 (1926).

Neuropogon antarcticus (Du Rietz) M. Lamb in *Journ. Linn. Soc. Lond. Bot.* 52 : 210 (1939).

Thallus erect or subprostrate. 1–5cm tall, irregularly branched, rigid, verrucose, rugose, slightly foveolate, straw colour to pale yellow-green, up to 1.5mm thick at the base, at times somewhat constricted at attachment, uppermost tips of the branches black or with black bands, smooth, shining, sorediose, but in old specimens sometimes black, dull and extremely eroded. *Soredia* usually abundant, foveolate, convexed, whitish-yellow. *Cortex* 60 μ thick. *Algal cells* up to 8 μ diam., scattered in small colonies throughout the medulla. *Medulla* up to 160 μ thick, white, dense against the cortex, becoming looser near the axis. *Axis* solid 45–150 μ thick, composed of longitudinal conglutinate hyphae 1 μ diam. *Apothecia* not seen.

REACTIONS: K–, C–, P–, KC–.

CHEMISTRY: All of the specimens from the study area occur in the typical or inactive phase. Usnic acid was the only constituent demonstrated.

SPECIMENS EXAMINED: Clarke Peninsula, Wilkes Station, W. A. Groom, 1966 (MEL 26100); Clarke Peninsula, near NMA/S/39, B. M. Allwright, 15.i.1972 (with *Alectoria minuscula*, MEL 1012010); Clarke Peninsula, at G5, R. Anderson, 15.i.1970 (MEL 1012049); Bailey Peninsula, near Rx site, D. J. Luders CB73/07b, 8.xi.1972 (MEL 1011984); Bailey Peninsula, downhill to the north of G11, R. Anderson, 27.ii.1969 (MEL 1012026); Casey Station, D. J. Bishop, 6.ii.1971 (MEL 1012054); rock outcrop on north side of Mitchell Peninsula due south of small island in O'Brien Bay, R. Anderson, 2.iii.1969 (with *Lecanora rubina* var. *melanophthalma*, forma *exsulans*, MEL 1012021); moraine at east end of Robinson Ridge, R. Anderson, 2.iii.1969 (MEL 1012024); Browning Peninsula, near the plateau, R. Anderson, 5.i.1970 (MEL 1012039); north-east side of Browning Peninsula, D. J. Bishop, 26.x.1970 (MEL 1012066); eastern side of Haupt Nunataks, R. Anderson, 3.i.1970 (MEL 1012034); western side of the Haupt Nunataks, R. Anderson, 3.i.1970 (with *Alectoria minuscula*, MEL 1012036); Haupt Nunataks, D. J. Bishop, 24.x.1970 (MEL 1012073).

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TAXONOMY AND DISTRIBUTION OF *RUBUS FRUTICOSUS* L. AGG. (ROSACEAE) NATURALIZED IN VICTORIA

by

R. L. AMOR* and the late B. A. MILES†

[EDITOR'S NOTE: During 1966 the senior author, R. L. Amor, commenced a detailed examination of all naturalized species of *Rubus* occurring in Victoria with the intention of determining the most satisfactory means of controlling these noxious weeds. His endeavours soon led him to conclude that this genus was a complex one and that its taxonomy required special attention. Subsequently he enlisted the aid of the late B. A. Miles (the junior author) in identifying the several species involved and later the two authors co-operated in the production of a paper on the taxonomy of the genus *Rubus* in Victoria. Unfortunately Mr. Miles died on 26th January, 1970, before he completed his taxonomic revision. However, Dr. Amor continued the preparation of this paper but was placed at a disadvantage with respect to its taxonomic content because he was unable to refer to Mr. Miles' notes which were presumably among his personal effects. The article presented below contains only one reference to a *type* specimen (*Rubus cissburiensis*) and it therefore lacks that data necessary for allowing credence to be given to the conclusions reached in applying the different species names referred to in the text. In spite of this obvious short-coming, the publication of this paper in its present form is deemed necessary because it provides Australian botanists with valuable data on the taxonomy of these species for immediate use, and it has been accepted for publication on this basis.]

SUMMARY

This paper describes the general morphology of blackberry (*Rubus fruticosus* L. agg.), the eight species of the aggregate and hybrids that are naturalized in Victoria, and the distribution of the taxa in both Europe and Victoria. The origin of the European *Rubus* flora, nomenclatural problems encountered in the segregates, the possible means by which the species were introduced into Victoria, and factors affecting their present distribution are also discussed.

INTRODUCTION

Gustafsson (1942) divided European blackberry species into two complexes, the *Moriferi veri* and the *Corylifolii*. He postulated that the progenitors of the *Moriferi veri* occurred in Pliocene times and that some of the primary species survived the last glaciation and spread when conditions became more favourable. Recent blackberry species are presumably progenies and segregates of hybrids between the primary species. Gustafsson considered that the *Corylifolii* originated as crosses between the *Moriferi veri* and the dewberry (*Rubus caesius*).

* Keith Turnbull Research Station, Frankston, Victoria.

† South London Botanical Institute, England.

The term *R. fruticosus* agg., as it is now used, does not include *R. caesius* or the *Corylifolii* (Heslop-Harrison, 1968).

The basic chromosome number in *Rubus* is $n = 7$ and there are a range of polyploids (Heslop-Harrison, 1953). Only one British species (*R. ulmifolius*) is known to be a sexually reproducing diploid, and 4.3 per cent. of the other species are triploid, 90.7 per cent. tetraploid, 3.4 per cent. pentaploid and 0.8 per cent. hexaploid. Heslop-Harrison showed that these proportions are more or less similar to those in continental *Rubus* species.

Most European blackberry species produce seed by pseudogamy. Apomixis in the aggregate is facultative, and new apomictic biotypes arise occasionally by hybridization between different pseudogamous species or between sexual and pseudogamous species (Gustafsson, 1942). The large number of species and the lack of standardized sampling procedures and nomenclature used in the past have led to much confusion in the nomenclature. References to the key works of Focke, Sudre, Rogers and others are listed by Watson (1958).

The taxonomy of blackberry has received little attention in Australia. In Queensland and Western Australia blackberry is referred to as *R. fruticosus* L. (Everist, 1957; Meadly, 1965); in Victoria and Tasmania as two taxa—*R. fruticosus* L. and *R. laciniatus* Willd (Ewart, 1930; Curtis, 1956); and in New South Wales as *R. vulgaris* Weihe & Nees (Whittet, 1958; Beadle, Evans and Carolin, 1962). In South Australia, Eichler (1965) considers that there are several species, including *R. procerus* P. J. Muell.; *R. ulmifolius* Schott, *R. sp.* (aff. *R. fuscus* Weihe & Nees) and *R. sp.* (aff. *R. koehleri* Weihe & Nees). The taxonomy and distribution of the eight species of *R. fruticosus* agg. naturalized in Victoria are described below.

METHODS

The distribution of *Rubus fruticosus* agg. in Victoria, based on its presence in the 140 Lands Department Inspectors' Districts, was known from a preliminary survey (Amor, 1968), and the same mapping unit was used in this study. To ensure that the main occurrences of blackberry in each district were examined, inspections were carried out in the company of the local inspectors responsible for the control of blackberry and other noxious weeds. Specimens were collected from up to six localities for each species, the number of localities depending on the geographic range of the species.

The specimens consisted of the following material:

- (a) Pieces of stem, approximately 8cm long, with leaves attached. These stem pieces were taken from the

middle of a primocane* and not from the basal one metre of the cane.

(b) A complete inflorescence, usually bearing flowers and young fruit.

(c) Separate petals.

Further details of desirable methods of collecting *Rubus* specimens are given by Watson (1958) and Edees (1959).

The descriptions that follow refer to plants growing in a fairly sunny situation. In deep shade most species have green stems and are generally less tomentose and more pilose. When plants were growing in full sunlight the colour of the petals was noted in an opening bud, because the petals are soon bleached. Unless stated otherwise, the leaves described are those on the primocanes. Hairiness of carpels is described at anthesis. Definitions of the terms used above and in the following pages are shown in Figure 11.

The species were identified initially by B. A. Miles and the identifications confirmed by E. S. Edees, Dartmouth Avenue, Newcastle, England. Duplicate herbarium specimens have been filed at the Keith Turnbull Research Station, the National Herbarium of Victoria (Melbourne), and the Botany School of the Cambridge University, England.

DESCRIPTIONS

Rubus L. Subgen. *Rubus* (*Rubus fruticosus* L. agg.)

Prickly perennial *shrub* often forming large clumps 0.3–7m high. *Roots* perennial. *Stems* biennial or less often perennial, arching and rooting where the apices touch the ground, sharply to bluntly 5-angled, bearing prickles on the angles and often on the faces, glabrous or pilose and/or tomentose, and often also bearing glands and pricklets, overwintering (leaves usually deciduous) and producing in their second (and sometimes subsequent) year flowering branches from axillary buds formed the previous autumn. *Leaves* alternate, petiolate, stipulate, with 3–5 leaflets; leaflets shortly stalked, their upper surfaces glabrous or pilose, their lower surfaces thinly to strongly pilose, often also tomentose; always toothed; armature of petioles and petiolules similar to that of stem. *Flowering branch* a leafy elongated cyme, pyramidal to cylindrical in outline; all branches of the inflorescence subtended by either leaves or bracts (the leaves grading from proximally digitate to distally simple); armature and indumentum of branches similar to that of stem, but always more dense. *Flowers* hermaphrodite, actinomorphic, weakly perigynous, usually 5-merous, 2–3cm in diameter. *Hypanthium* (disc) flat, with a large convex receptacle. *Sepals* usually five, entire. *Petals* five, alternating with the sepals, caducous, white to deep pink. *Stamens* numerous, arising from

* A first-year cane. These do not bear flowers (Bailey, 1941).

STEM (T.S.)



Round



Angled, flat sides



Angled, concave sides

ARMATURE



Patent prickles

Deflexed prickles

Falcate prickles

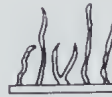
Pricklets

Stalked glands

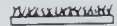
INDUMENTUM



Glabrous



Pilose



Tomentose

TERMINAL LEAFLET



Elliptical



Suborbicular



Obovate



Acuminate



Mucronate



Rounded



Crenate

INFLORESCENCE



Cylindrical



Pyramidal

FLOWER



Anthers at same level as stigmas



Anthers at higher level than stigmas

Fig. 11.—Terms used to describe parts of *Rubus* plants.

the rim of the hypanthium; filaments slender, white or more rarely pink; anthers yellow, versatile. *Carpels* numerous, free, glabrous or pilose. *Styles* subterminal, filamentous, greenish-white to pink, *Ovules* two, of which only one develops. *Fruit* a coherent head of black, shiny one-seeded drupelets, adherent to the convex receptacle. *Seeds* reticulate. *Cotyledons* two, elliptic, ciliate.

KEY TO SPECIES OF *R. fruticosus* agg. IN VICTORIA

- 1 Primocane with abundant stalked glands 9 *R. rosaceus*
 Primocane with few or no stalked glands 2
- 2 Leaflets deeply divided (at least $\frac{1}{2}$ way to midrib) 2 *R. laciniatus*
 Leaflets not deeply divided 3
- 3 Stalked glands present on rachis, branches and
 sepals of inflorescence 4
 Inflorescence eglandular 6
- 4 Primocane strongly pilose 8 *R. vestitus*
 Primocane glabrous or very slightly pilose 5
- 5 One simple leaf above ternate leaves in inflorescence;
 petioles of inflorescence leaves with glands not
 more than 0.5mm long; lower portion of rachis
 of inflorescence pilose; petals 1.0–1.4 times as
 long as broad, not notched. 3 *R. polyanthemus*
 Two or more simple leaves above ternate leaves in
 inflorescence; petioles of inflorescence leaves with
 some glands up to 1mm long; lower portion of
 rachis of inflorescence glabrous or nearly so;
 petals 1.5–1.8 times as long as broad, notched 4 *R. cissburiensis*
- 6 Lower surface of leaves white tomentose but not
 pilose 5 *R. ulmifolius*
 Lower surface of leaves pilose, sometimes also
 tomentose 7
- 7 Terminal leaflet suborbicular, prickles on peduncles
 strongly curved; anthers at same level as stigmas;
 petals strongly notched 1 *R. selmeri*
 Anthers at higher level than stigmas; not with the
 same character combination as *selmeri* 8
- 8 Lower surface of leaves on stem green, not or slightly
 felted, leaves mostly obovate 3 *R. polyanthemus*
 Lower surface of leaves on stem grey or white felted,
 leaves usually not obovate 9
- 9 Primocane more or less glabrous, sides usually concave 7 *R. procerus*
 Primocane often pilose and often with slightly felted
 sides flat 6 *R. ulmifolius* hybrids

1. ***Rubus selmeri*** Lindeb. *Herb. Rub. Scand.* 2: no. 33 (1884); F. Aresch. in *Bot. Not.* 1886: 76 (1886); Sudre *Rubi Eur.* 24 (1908); Focke in *Biblthca Bot.* 83: 138 (1914); Y. Heslop-Harrison in Tutin et al. *Fl. Europaea* 2: 11 (1968). *R. villicaulis*



Fig. 12.—*R. selmeri*. Scale = 5cm.

subsp. *selmeri* (Lindeb.) Rogers *Handb. Brit. Rubi* 35 (1900). *R. nemoralis* sensu W. C. R. Watson *Hand. Rub. Gt. Brit. Ireland* 66 (1958), non P. J. Mueller in *Flora Regensb.* 41: 139 (1858). [Fig. 12.]

Stem brown to deep purple, glabrous or thinly pilose, eglandular, not tomentose; faces more or less, concave; prickles mostly deflexed, some more or less falcate. *Leaves* 5-partite; petioles and petiolules pilose, armed with falcate prickles; upper surface of leaflets more or less glabrous, lower surface softly and densely pilose and green to greyish tomentose; terminal leaflet suborbicular occasionally broadly elliptic, apex acuminate, occasionally mucronate, base rounded. *Inflorescence* cylindrical or subpyramidal in outline, rachis and all branches pilose and very thinly tomentose, armed with strong, large-based, falcate prickles. *Sepals* with short, green, linear tips their outer surfaces densely pilose and tomentose (hair often yellowish),



Fig. 13.—Distribution of *R. selmeri* in Victoria, based on presence in Lands Department Inspectors' Districts.

with a few tiny pricklets. *Petals* pink, 8–11mm long, broadly elliptic-obovate, strongly notched at apex. *Anthers* at same level as stigmas; filaments often pinkish at base. *Carpels* usually somewhat pilose.

EUROPEAN DISTRIBUTION: Britain, Denmark, Germany, Ireland, Holland, Norway. A common species of N.W. Europe.

VICTORIAN DISTRIBUTION: [Fig. 13] Clunes, Creswick and 2 miles north of Tannybryn. Not abundant.

SPECIMENS EXAMINED: Victoria—Creswick, *R. L. Amor* RA24, i.1967 (CGE; KTRS*; MEL 500015, 500016, 500017); Tannybryn, *R. L. Amor* 35, i.1967 (KTRS; MEL 500018).

* Keith Turnbull Research Station, Frankston, Victoria.

R. selmeri Lindeb. (1884) was relegated to the synonymy of *R. nemoralis* P. J. Muell. (1858) by W. C. R. Watson (1958, p. 66). *R. selmeri* has been used by nearly all European botanists for this common and well-known species of N.W. Europe. However, this name has been used for several different species and its correct application is in doubt.

2. ***Rubus laciniatus*** Willd. in *Hort. Berol.* 2 (7): pl. lxxxii (1806); Rogers *Handb. Brit. Rubi* vii (1900); Sudre *Rubi Eur.* 55 (1909); Focke in *Biblthca Bot.* 83: 134 (1914); W. C. R. Watson *Handb. Rubi Gt. Britain Ireland* 67 (1958); Y. Heslop-Harrison in Tutin et al. *Fl. Europaea* 2: 13 (1968). [Fig. 14.]

Stem and leaves as in *R. selmeri*, but leaflets deeply lacinate, often divided to midrib. *Inflorescence* variable in outline, often more or less cylindrical, all branches armed with strong, large-based, deflexed, falcate prickles. *Sepals* with long (up to 4mm) linear tips (the tips sometimes greatly enlarged into leafy structures) their outer surfaces densely pilose and tomentose, with numerous tiny pricklets. *Petals* pink or white, longer than in *R. selmeri* (up to 15mm), obovate, very variable at apex, sometimes deeply notched, sometimes rounded, sometimes mucronate. *Anthers* at same level as stigmas; filaments often pinkish at base. *Carpels* glabrous or slightly pilose.

EUROPEAN DISTRIBUTION: Cultivated for ornament and widely naturalized in many areas. Origin unknown.

VICTORIAN DISTRIBUTION [Fig. 15]: Otway Ranges, Central Victoria, Dandenong Ranges, Gippsland, North-eastern Victoria. Widespread, but not abundant, characteristically occurring as widely spaced, bird-sown plants.

SPECIMENS EXAMINED: Victoria—Lavers Hill, *R. L. Amor* s. n., i.1969 (CGE; KTRS; MEL 500019); Ballarat, *H. Balde* HB3 (KTRS; MEL 500020, 500021); Balook, *R. L. Amor* RA8, i.1967 (KTRS; MEL 500022, 500023).

3. ***Rubus polyanthemus*** Lindeb. *Herb. Rub. Scand.* 1: no. 16 (1882) et in *Bot. Not.* 1883: 105 (1883); Neuman in *Kongl. Vetensk. Akad. Förh. Stockholm* 1883 (8): 65 (1883); Sudre *Rubi Eur.* 61 (1909); W. C. R. Watson *Handb. Rubi Gt. Britain Ireland* 89 (1958); Y. Heslop-Harrison in Tutin et al. *Fl. Europaea* 2: 14 (1968). *R. pulcherrimus* Neuman in *Lunds. Bot. Foreningsbyteskatalog* (1882); Rogers *Handb. Brit. Rubi* 32 (1900); Focke in *Biblthca Bot.* 83: 125 (1914); non W. J. Hooker in *Icones Pl.* 8: dcxxx (1848). *R. neumanii* Focke in *Potonie Illust. Fl. Nord- und Mittel-Deutschl.* 257 (1886); Frider & Gelert in *Bot. Tideskr.* 16: 79 (1888). [Fig. 16.]



Fig. 14.—*R. laciniatus*. Scale = 5cm.

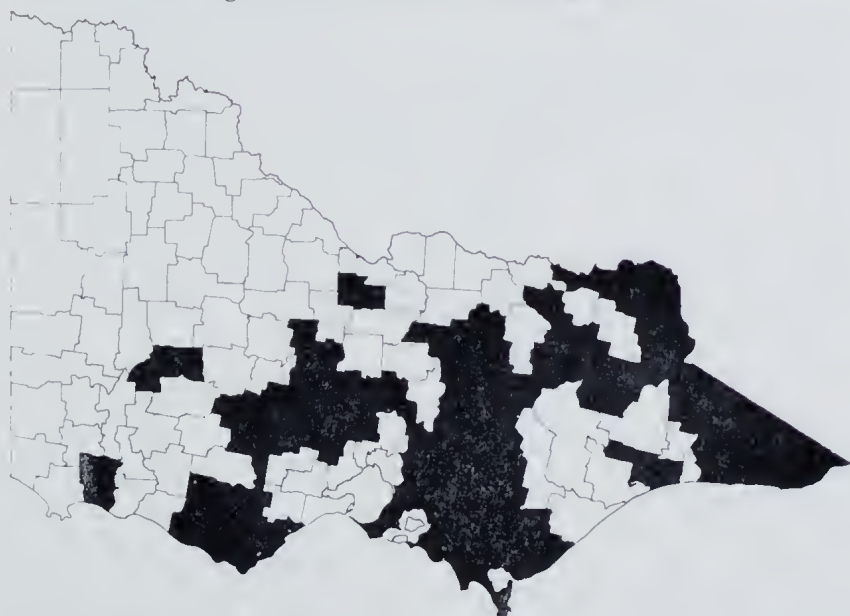


Fig. 15.—Distribution of *R. laciniatus* in Victoria, based on presence in Lands Department Inspectors' Districts.

Stem brown or pinkish, sparsely pilose when young, glabrescent, eglandular, not tomentose; faces usually more or less flat; prickles mostly deflexed, some more or less patent. *Leaves* 5-partite; petioles and petiolules pilose and often also thinly tomentose, armed with falcate and deflexed prickles; upper surface of leaflets sparsely pilose, lower surface green or grey-green, (subglabrous-) thinly-moderately pilose, not or thinly tomentose, armed with falcate and deflexed prickles; suborbicular, apex acuminate, base rounded. *Inflorescence* more or less cylindrical in outline, with single leaf above ternate leaves, rachis and all branches pilose and green to greyish-



Fig. 16.—*R. polyanthemus*. Scale 5cm.

tomentose, armed with mostly deflexed prickles, glands none to numerous, up to 0.5mm long. *Sepals* with short (usually up to 2.5mm long) linear tips; their outer surfaces grey tomentose and very shortly pilose, pricklets very rare or none; bases of inner surfaces rarely turning crimson during fruit development. *Petals* pale pink or white, 8–13mm long, suborbicular, 1.0–1.4 times as long as broad, rounded or slightly notched at apex. *Anthers* at higher level than stigmas; filaments white or pinkish. *Carpels* glabrous or with few hairs.

EUROPEAN DISTRIBUTION: Britain, Denmark, Germany, Ireland, Holland, Sweden.

VICTORIAN DISTRIBUTION [Fig. 17]: Otway Ranges, Ballarat, Clunes, Erica, South Gippsland Hills, East Gippsland.

SPECIMENS EXAMINED: Victoria—Beech Forest, *R. L. Amor* RA20, i.1967 (KTRS; MEL 500024, 500025, 500026); Lorne, *R. L. Amor* RA17, i.1967 (KTRS; MEL 500027, 500028, 500029); Daylesford, *H. Balde* HB4, ii.1967 (CGE; KTRS; MEL 500030); Warragul, *R. L. Amor* RA4, i.1967 (KTRS; MEL 500031, 500032, 500033); Erica, *R. L. Amor* RA6, i.1967 (KTRS; MEL 500034, 500035).

4. *Rubus cissburiensis* Barton & Riddelsd. in *Journ. Bot. (London)* 69: 238 (1931). *R. erythrinus* forma *glandulosus* Rogers in *Rep. Bot. Soc. Exch. Cl. Brit. Isles* 1: 542 (1898 pro



Fig. 17.—Distribution of *R. polyanthemus* in Victoria, based on presence in Lands Department Inspectors' Districts.

1897). *R. separinus* sensu W. C. R. Watson *Handb. Rubi Gt. Britain Ireland* 93 (1958), non Genev. in *Mem. Soc. Acad. (Angers)* 8:90 (1860). [Fig. 18.]

Stem purplish to very deep blackish-purple, becoming scaly as it gets older, glabrous or nearly so, eglandular, not tomentose; faces flat or sometimes convex; prickles mostly deflexed, some more or less patent or slightly falcate. *Leaves* most 5-partite; petioles and petiolules subglabrous, very sparsely tomentose, sometimes with a very few glands, armed with falcate, deflexed prickles; upper surface of leaflets glabrous; lower surface green to greyish tomentose and thinly pilose below; terminal leaflet elliptical, rarely obovate, apex acuminate, base rounded.

Inflorescence pyramidal or less often more or less cylindrical in outline, with two or more simple leaves above ternate leaves; lower part of rachis subglabrous, upper part of all branches thinly grey-green tomentose and sparingly pilose, armed with mostly deflexed prickles and often also pricklets, glands numerous, the largest about 1.5 (—2) mm long. *Sepals* with linear tips, often more than 2.5 mm long; their outer surfaces



Fig. 18.—*R. cissburiensis*. Scale = 5 cm.

clothed as the upper panicle branches; bases of inner surfaces becoming crimson during fruit development. *Petals* at first pinkish, but soon turning white, 8–15 mm long, rhomboid to elliptic, 1.5–1.8 times as long as broad, usually notched at apex. *Anthers* at higher level than stigmas; filaments white. *Carpels* sparingly pilose.

EUROPEAN DISTRIBUTION: Known certainly only in S.E. England, but possibly also in France.

VICTORIAN DISTRIBUTION [Fig. 19]: Otway Ranges, Panmure, Rubicon River, Budgeree East.

SPECIMENS EXAMINED: Victoria—Eildon, *R. L. Amor* RA16, ii.1967 (KTRS; MEL 500036, 500037, 500038); Morwell, *R. L. Amor* RA7, i.1967 (KTRS; MEL 500039, 500040); English's Corner, *H. Balde* 43, ii.1968 (KTRS; MEL 500041, 500042).

R. cissburiensis Barton & Riddelsd. (1931) was relegated to the synonymy of *R. separinus* Genev. (1860) by W. C. R. Watson



Fig. 19.—Distribution of *R. cissburiensis* in Victoria, based on presence in Lands Department Inspectors' Districts.

(1958: 93). The holotype of *R. cissburiensis* in the British Museum (Nat. Hist.) has been examined by one of us (B.A.M.) whereas no lectotype has been selected for *R. separinus*, and its identity with the English *R. cissburiensis* in questionable.

5. ***Rubus ulmifolius*** Schott in *Isis* 1818: 821 (1818); Sudre *Rubi Eur.* 69 (1909); Focke in *Biblthca Bot.* 83: 153 (1914); W. C. R. Watson *Handb. Rubi Gt. Britain Ireland* 97 (1958); Y. Heslop-Harrison in Tutin et al. *Fl. Europaea* 2: 15 (1968). *R. rusticanus* Merc. in Reuter *Cat. Pl. Vasc. Geneve* ed 2, 279 (1861); Rogers *Handb. Brit. Rubi* 40 (1900). *R. discolor* auct. mult., non Weihe & Nees *Rubi Germ.* 30 (1824). [Fig. 20.]



Fig. 20.—*R. ulmifolius*. Scale = 5cm.

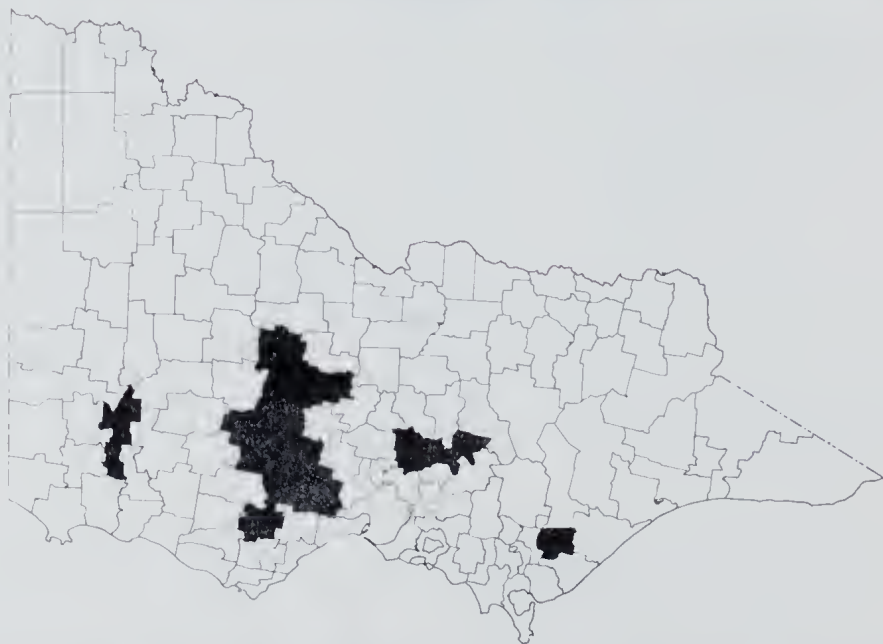


Fig. 21.—Distribution of *R. ulmifolius* in Victoria, based on presence in Lands Department Inspectors' Districts.

Stem blackish-purple, developing a scaly whitish covering as it ages, glabrous or nearly so, eglandular, not tomentose; faces flat or concave; prickles few to numerous, patent, deflexed or falcate. *Leaves* 5-partite; petioles and petiolules thinly pilose and tomentose, becoming scaly like the stem, armed with short, but large-based mostly falcate prickles; leaflets subcoriaceous, upper surface subglabrous, densely and closely white tomentose, but the lower surface only slightly or not pilose; terminal leaflet very variable in shape, most commonly oblong, but sometimes obovate or broadly elliptical, apex mucronate or less often acuminate, base rounded. *Inflorescence* narrowly cylindrical, occasionally broadly pyramidal in outline, more or less leafless in the flowering part; rachis and all branches grey-whitish tomentose, not or very thinly pilose, eglandular, prickles very variable as on stem. *Sepals* with very short (less than 1mm long) linear tips, their outer surfaces white-tomentose not or hardly pilose, eglandular, pricklets none. *Petals* usually deep pink, 7–9mm long, crumpled, suborbicular, margins wavy. *Anthers* at same level as stigmas; filaments and styles pink. *Carpels* more or less pilose.

EUROPEAN DISTRIBUTION: South, west and central Europe as far north as Germany, Holland, and N. England (also in N. Africa and parts of western Asia).

VICTORIAN DISTRIBUTION [Fig. 21]: Mainly in the Ballarat-Daylesford districts, but with isolated patches at Hamilton, Colac, Kinglake and Traralgon.

SPECIMENS EXAMINED: Victoria—Ballarat, *H. Balde* HB2, i.1967 (CGE; KTRS; MEL 500043, 500044); Ballarat, *R. L. Amor* RA23, i.1967 (KTRS); MEL 500045, 500046); Mt. Slide, *R. L. Amor* s.n., i.1968 (CGE; KTRS; MEL 500047, 500048).

A very distinct, yet variable sexually reproducing species. It is sometimes difficult to tell whether a plant is a variant of this species or a hybrid with a closely related pseudogamous one. If the pollen is partly sterile and the fruit imperfect, a hybrid origin may be suspected.

6. *Rubus ulmifolius* hybrids.

Resemble *R. ulmifolius* in the scaly stems; white tomentose lower surface of leaflets; eglandular inflorescence; densely white tomentose, very short-tipped sepals; pink, crumpled, suborbicular petals with wavy margins; anthers at same level as stigmas; pink filaments and styles and pilose carpels. Differ from *R. ulmifolius* in the moderately to strongly pilose stem; often 3-partite leaves; pilose leaflets; elliptical to suborbicular, often cordate-based terminal leaflet; rachis and all branches of inflorescence pilose; and imperfect fruit. Not all plants possess all resemblances and all differences mentioned above.



Fig. 22.—*R. ulmifolius* x (?) hybrid. Scale — 5cm.



Fig. 23.—Distribution of *R. ulmifolius* hybrids in Victoria, based on presence in Lands Department Inspectors' Districts.

EUROPEAN DISTRIBUTION: Throughout the range of *R. ulmifolius*.

VICTORIAN DISTRIBUTION [Fig. 23]: Widely distributed, growing north of the Dividing Range in drier areas than other species with the exception of *R. procerus*. Common in old gold mining districts and the dominant form of blackberry in south-



Fig. 24.—*R. procerus*. Scale 5cm.

western Victoria (west of the Otway Ranges), in the Foster Hills, and north of the Dividing Range. In other areas *R. ulmifolius* hybrids are less abundant and there is usually more *R. procerus* or *R. polyanthemus*.

SPECIMENS EXAMINED: Victoria—Bethanga, *R. L. Amor* RA2, i.1967 (KTRS; MEL 500049, 500050, 500051); Foster, *H. Balde* 42, ii.1968 (CGE; KTRS; MEL 500052, 500053, 500054); Flinders, *R. L. Amor* RA5, i.1967 (KTRS; MEL 500055, 500056, 500057, 500058); Warragul, *R. A. Amor* RA3, i.1967 (KTRS; MEL 500059, 500060).

R. ulmifolius hybrids occur extensively in England and it is not surprising that they have become naturalized. In Victoria they are variable, but separation into several categories is not considered to be desirable. In Europe unless a *R. ulmifolius* hybrid is found growing with its other parent, it is almost impossible to be certain of the identity of that parent, as the characters of *R. ulmifolius* predominate. The parentage of the hybrids in Victoria can only be guessed, but it is suspected that *R. vestitus* may be a parent of some of the hybrids. *R. ulmifolius* x *R. vestitus* hybrids are common in England.



Fig. 25.—Distribution of *R. procerus* in Victoria, based on presence in Lands Department Inspectors' Districts.

7. ***Rubus procerus*** P. J. Muell. in Boulay Ronces Vosg. 7 (1864); Sudre *Rubi Eur.* 87 (1910). *R. hedycarpus* subsp. *procerus* (P. J. Muell.) Focke in *Bibliotheca Bot.* 83 : 162 (1914). *R. discolor* sensu Y. Heslop-Harrison in Tutin et. al. *Fl. Europaea* 2 : 16 (1968). [Fig. 24.]

Stem brown to purple, glabrous or nearly so, eglandular, not tomentose; faces usually more or less concave; prickles mostly deflexed, a few more or less patent or slightly falcate. Leaves 5-partite; petioles and petiolules very thinly pilose and

tomentose, armed with falcate prickles; upper surface of leaflets more or less glabrous, lower surface white or greyish-white tomentose and sparingly short-pilose; terminal leaflet broadly elliptic, occasionally suborbicular, apex acuminate, base rounded. *Inflorescence* usually pyramidal in outline with a broad, blunt apex; rachis and all branches pilose and greenish-grey tomentose, particularly in upper part of rachis, armed with mostly deflexed prickles. *Sepals* with short (usually less than 2.5mm) linear tips, their outer surfaces greyish tomentose, moderately to strongly pilose (hair often yellowish), pricklets none. *Petals* pinkish, very large, 12–15mm long, broadly elliptic-



Fig. 26.—*R. vestitus*. Scale 5cm.

suborbicular, rounded or very slightly notched at apex. *Anthers* at higher level than stigmas; filaments white. *Carpels* more or less pilose.

EUROPEAN DISTRIBUTION: Eastern England, Belgium, Germany and France. Recorded from other areas, but probably due to misidentification.

VICTORIAN DISTRIBUTION [Fig. 25]: Far western Victoria, Otway Ranges, Melbourne district, throughout Gippsland and north-east Victoria, Cohuna. The most widely distributed species.

SPECIMENS EXAMINED: Victoria—Tannybryn, *R. L. Amor* s. n., i.1969 (KTRS; MEL 500061, 500062); Tecoma, *R. L. Amor* s. n., i.1969 (CGE; KTRS; MEL 500063, 500064, 500065); Rowville, *R. L. Amor* RA16, i.1967 (KTRS; MEL 500066); Frankston, *R. L. Amor* s. n., i.1969 (KTRS; MEL 500067, 500068, 500069, 500070, 500071).

Y. Heslop-Harrison (1963: 16) cites *R. procerus* P. J. Muell. (1864) as a synonym of *R. discolor* Weihe & Nees (1824). The



Fig. 27.—Distribution of *R. vestitus* in Victoria, based on presence in Lands Department Inspectors' Districts.

reason for this is that Sudre (1908–1913) has this synonymy. However, until there is proof that the two names refer to the same species, the authors prefer to use *R. procerus* by which the species is well-known, rather than *R. discolor* which has commonly been referred to the synonymy of *R. ulmifolius* Shott.

8. ***Rubus vestitus*** Weihe & Nees in Bluff & Fingerh. *Comp. Fl. Germ.* 1: 684 (1825); Sudre *Rubi Eur.* 101 (1910); Focke in *Bibliotheca Bot.* 83: 194 (1914); W. C. R. Watson *Handb. Rubi Gt.*

Britain Ireland 114 (1958); Y. Heslop-Harrison in Tutin et al. *Fl. Europaea* 2: 17 (1968). *R. leucostachys* sensu Rogers *Handb. Brit. Rubi* 50 (1900) et auct. mult., non Schleicher ex Sm. *Engl. Fl.* 2: 403 (1824). [Fig. 26.]

Stem brown to purple, pilose and thinly tomentose, eglandular or nearly so; faces more or less flat; prickles mostly deflexed, a few more or less patent or slightly falcate. *Leaves* 5-partite; petioles and petiolules pilose and thinly tomentose, often with a few glands, armed with mostly falcate prickles; upper surface of leaflets sparsely pilose, lower surface densely grey to white tomentose and strongly pilose; terminal leaflet suborbicular, apex acuminate, base rounded. *Inflorescence* narrowly to broadly pyramidal in outline; rachis and all branches densely pilose and tomentose; armed with mostly deflexed prickles, glands few to numerous, the longest c. 2mm long. *Sepals* with linear tips varying from 2–4mm, their outer surfaces densely pilose and greyish tomentose, with numerous glands and pricklets. *Petals* pink or white, 10–14mm long, broadly ovate-suborbicular, rounded or less often slightly notched at apex. *Anthers* at higher level than stigmas; filaments white. *Carpels* pilose.

EUROPEAN DISTRIBUTION: From Roumania and Poland to Sweden and Ireland, south to Italy and Portugal.

VICTORIAN DISTRIBUTION [Fig. 27]: Laver's Hill, Lower Gellibrand, Panmure and at The Glut in the Beaufort district.

SPECIMEN EXAMINED: Victoria—Gellibrand River, *R. L. Amor* RA21, i.1967 (MEL 500072).

9. ***Rubus rosaceus*** Weihe & Nees in Bluff & Fingerh. *Comp. Fl. Germ.* a 1: 685 (1825) fide W. C. R. Watson in *Rep. Bot. Soc. Exch. Club. Brit. Is.* 8: 862 (1929); *Watsonia* 1: 78 (1949) et *Handb. Rubi Gt. Britain Ireland* 178 (1958). *R. viridis* sensu Rogers *Handb. Brit. Rubi* 85 (1900), non C. Presl ex Ortman in *Flora (Regensb.)* 18: 488 (1835), nec Kaltenb. *Fl. Aachen Beck* 2: 284 (1845). *R. leptadenes* var. *calliphylloides* (Sudre) Sudre *Rubi Eur.* 220 (1913) quoad loc. angl. [Fig. 28.]

Stem becoming blackish-purple on exposure, slightly pilose, not tomentose, strongly glandular; faces more or less flat, prickles weak, mostly falcate, pricklets numerous. *Leaves* 3–5-partite; petioles and petiolules thinly pilose, not tomentose, strongly glandular, armed with many small mostly falcate prickles and pricklets; upper surface of leaflets subglabrous, lower surface subglabrous to rather thinly pilose (never tomentose); terminal leaflet broadly ovate or elliptic, apex acute to slightly acuminate, base rounded. *Inflorescence* pyramidal in outline, with long lower branches and a narrow apex; rachis and all branches thinly pilose, not tomentose, armed with weak,

falcate prickles and abundant pricklets, glands very abundant, the longest c. 2.5 (—3) mm. *Sepals* with linear (or often leafy) tips 2–6 mm long, their outer surfaces green (hardly tomentose) with conspicuous white tomentose margins slightly pilose, densely glandular, pricklets often numerous. *Petals* pinkish, 8–12 mm long, narrowly elliptic, rounded at apex. *Anthers* at same level or slightly higher than stigmas; filaments white, styles pink to purple based. *Carpels* pilose.

EUROPEAN DISTRIBUTION: S.E. England, mainly in woods; Belgium; W. Germany.



Fig. 28.—*R. rosaceus*. Scale — 5 cm.

VICTORIAN DISTRIBUTION [Fig. 29]: Digby, Portland, Mt. Eccles, Lavers Hill, Gellibrand River.

SPECIMENS EXAMINED: Victoria—Digby, *R. L. Amor* s. n., i.1969 (KTRS; MEL 500080, 500081, 500082); Portland, *R. L. Amor* RA22, i.1966 (KTRS; MEL 500074, 500075, 500076, 500077, 500078); Laver's Hill, *R. L. Amor* s. n., i.1968 (KTRS; MEL 500083, 500084); Laver's Hill, *R. L. Amor* s. n., i.1969 (CGE; MEL 500073, 500079).

Victorian specimens have been matched only with those of England. No specimens of *R. rosaceus* from Continental Europe have been seen, and it may be, on the basis of descriptions, that the British plant is different and requires a new name. The name *R. rosaceus*, however, is retained until this can be proved.

DISCUSSION

R. procerus, *R. ulmifolius* hybrids, and *R. polyanthemus* are the most widespread and abundant species of blackberry in Victoria. *R. laciniatus* grows in several districts, but never occurs extensively in any one district. *R. selmeri*, *R. cissburiensis*,



Fig. 29.—Distribution of *R. rosaceus* in Victoria, based on presence in Lands Department Inspectors' Districts.

R. ulmifolius, *R. rosaceus* and *R. vestitus* have a limited distribution and these taxa are all common in south-east England (Watson, 1958).

Their scattered distribution in Victoria suggests that there were several introductions. Blackberry was introduced into Victoria by early settlers from the British Isles, and the first

Director of the Melbourne Botanic Gardens recommended the planting of blackberry as a source of fruit and for the prevention of soil erosion in valleys. Several species were planted in the Botanic Gardens and subsequently "rendered available to various districts of the Colony" (Mueller, 1862). In addition to Mueller's introductions, the *R. ulmifolius* hybrid growing at Marong was probably introduced as seed from Scotland by an early settler (Wakefield, 1961). The most likely explanation for the present distribution of the species is that some were planted more extensively than others. It is assumed that few blackberries were planted after 1908 when *R. fruticosus* was declared a noxious weed for the whole State (Gov. Gaz., 1908).

It is possible that some early settlers grew several species of blackberry in order to have a range in maturity and flavour of berries. Evidence of this can be seen in a derelict garden at Creswick where there are old thickets of *R. ulmifolius*, *R. polyanthemus*, *R. selmeri* and *R. laciniatus*. The *R. vestitus*, *R. polyanthemus*, *R. rosaceus* and *R. laciniatus* along the Gellibrand River may also have originated from a neglected garden from which seed was dispersed by birds and foxes. In some areas only one species was planted e.g. *R. procerus* in the old mining and logging sites along the Omeo Highway in eastern Victoria.

The restricted local distribution of *R. laciniatus* compared with those of other species present in many districts—*R. procerus*, *R. ulmifolius* hybrids and *R. polyanthemus*—may be influenced by its method of reproduction. *R. laciniatus* occurs as bird-sown plants which do not root at the cane apices as frequently as the other species and do not develop extensive thickets. Restricted spread of *R. laciniatus* has been described over a longer period in England, where it was first recorded as a garden plant in 1754 (Watson, 1958).

In Victoria, blackberry grows only on land that has been disturbed by European man. It occurs where the average annual rainfall is greater than 760mm and also along creeks and irrigation-channel banks in drier areas (Amor, 1968). There is no clear evidence that the taxa naturalized in Victoria have different climatic or soil requirements for growth. The growth of *R. ulmifolius* hybrids north of the Dividing Range is associated with dry areas and neutral to alkaline soils, compared with wetter areas and acidic soils south of the Range. It could therefore be postulated that the *R. ulmifolius* hybrids have a greater tolerance of moisture stress and soil alkalinity than other species. The evidence that in Europe *R. ulmifolius* is one of the few species tolerant of these conditions supports this hypothesis. However, the correct explanation may be simply that other species were not introduced into these areas by the early settlers.

There is no evidence that hybrids between the species described have been formed in Victoria. Because of the abundance of hybrids in Europe, however, hybridization is to be expected in the future.

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A YELLOW FORM OF THE TASMANIAN WARATAH,
TELOPEA TRUNCATA (Labill.) R. Br.

by

A. M. GRAY*

Telopea truncata (Labill.) R. Br. forma *lutea* A. M. Gray,
f. nov.

Differt a *T. truncata* (Labill.) R. Br. sensu stricto: foliis magis oblanceolatis vel spathulatis, apicibus rotundatis et obtusis vel apiculatis, et floribus distincte luteis, omnio sine rubro. Holotypus: leg. Miss E. Huxley, Longley, Tasmania, 11.xi.1972 (FRI).

A yellow flowering form of *Telopea truncata*; it differs from *T. truncata* (Labill.) R. Br. in the strict sense, with leaves more oblanceolate or spathulate, and with the flowers distinctly yellow, red completely lacking.

The plant from which the holotype was selected was collected from Mt. Wellington, near Hobart, Tasmania and is now well established in a garden of exceptional merit belonging to Miss E. Huxley at Longley, 12 miles south of Hobart. Cuttings and layers have been successfully propagated and established and all produce the yellow form. Seedlings are usually either of the red or yellow form and intermediates are rarely observed. The yellow form tends to flower rather earlier than the typical red form and the flowering season extends from late October to the middle of December.

This description was compiled with the kind permission and on behalf of Miss E. Huxley.

* Forestry and Timber Bureau, Canberra, A.C.T.

THE STATUS OF BEDFORDIA ON THE AUSTRALIAN MAINLAND

by

A. M. GRAY*

Bedfordia arborescens Hochr. in *Candollea* 5 : 332-4 (1934)
vice *B. salicina* sens. auctt., non strict. (Labill.) DC.
Prodr. 6 : 441 (1838) [*Cacalia salicina* Labill. *Nov. Holl.*
Plant. Spec. 2 : 37 t. 179 (1806)].

Until early in 1973, the genus *Bedfordia* DC. was believed to consist of two species, *B. linearis* (Labill.) DC. which is restricted entirely to Tasmania and *B. salicina* (Labill.) DC., the mainland and Tasmanian forms of which were considered to be conspecific. Investigations into the status of the mainland form which occurs in Victoria and eastern N.S.W., including the ACT., have led to the discovery that a validly published name for the mainland plant has been in existence for about 40 years.

In ignorance of the fact that the mainland *Bedfordia* had been separated from its Tasmanian ally and named, the present author had undertaken research aimed eventually at a taxonomic separation of the mainland and Tasmanian forms, the two on examination being quite distinct. A request to the Australian Botanical Liaison Officer at the Herbarium, Royal Botanic Gardens, Kew, for a photograph of Labillardiere's type of *B. salicina*, elicited a reply which drew the author's attention to a description of *B. arborescens* by B. P. G. Hochreutiner together with photographs of the type. Examination of these photographs [the type of *B. arborescens* is lodged in the herbarium of the Conservatoire et Jardin Botaniques in Geneva and photographs of this type are also held in the Herbarium Australiense (CANB)] and comparison with material from throughout Victoria, New South Wales and the A.C.T. have demonstrated quite clearly that Hochreutiner's description of *B. arborescens* applies accurately to all mainland *Bedfordia* material. By coincidence, the existence of Hochreutiner's description had also been noted (almost at the same time) by Dr. N. T. Burbidge.

It appears that since 1934, Australian botanists have overlooked the existence of Hochreutiner's name for this taxon, and consequently all publications in which this genus has been featured have continued to refer the mainland *Bedfordia* to *B. salicina*.

* Forestry and Timber Bureau, Canberra, A.C.T.
Muelleria 3 (1): 64-66 (1974).

The Tasmanian *B. salicina* must be regarded as being restricted to that state. The author has collected and examined material from widely separated localities in southern and northern Tasmania but has not noted any plants which were not distinctly referable to *B. salicina*. Correspondingly, all mainland specimens examined show clear affinities to *B. arborescens*. Further, no intermediate forms between the two species or any significant variation have been observed. Thus the two species appear to be separated quite distinctly and are confined to their respective geographical ranges.

It is to be regretted that the type material for *B. arborescens* should have been lodged in a distant European herbarium with no known duplicates being distributed to Australian institutions.

<i>B. salicina</i>	<i>B. arborescens</i>
Leaves—10–17 x 1.0–2.5cm.	—18–24cm x 2.0–4.5cm.
Venation—impressed on upper surface, prominent on lower surface, not terminating at the margins with a mucro.	—impressed on upper surface, obscure and not readily noticeable on the lower surface, the major lateral veins terminating at the margins with a small, blunt mucro.
Margins—sub-crenate, shortly and closely revolute.	—crenate, obscurely revolute, the infolding obscured by the indumentum.
Indumentum—Very short and dense, a single layer of very closely appressed, tangled hairs, not obscuring the prominent veins.	—in two layers, the under layer dense, tangled and closely appressed; the secondary layer of long, floccose hairs obscuring the veins (the hairs of this “secondary” layer originate from the apices of glandular protuberances which arise from the cell surface; some of these long, tangled hairs may be irregularly branched 2–3 times, although the majority are quite simple).
Inflorescence—short, quite dense axillary panicles; <i>rhachis</i> quite stout; <i>rhachilla</i> short, stout; <i>axes</i> lengthening only slightly after anthesis; <i>peduncles</i> mostly absent or to 3mm long; <i>bracteoles</i> short, stout; <i>indumentum</i> very short, dense, the individual hairs not discernable to the unaided eye.	—long, loose axillary panicles or corymbs; <i>rhachis</i> relatively insubstantial, brittle; <i>rhachilla</i> almost as long as the <i>rhachis</i> , also thin and brittle; <i>axes</i> lengthening following anthesis; <i>peduncles</i> 1–2.5cm long; <i>bracteoles</i> long (c. 1.0cm), filiform, dry; <i>indumentum</i> long, loose but thick, the hairs quite distinguishable.

Table summarizing the major differences between
Bedfordia salicina and *B. arborescens*.

Fig. 30.

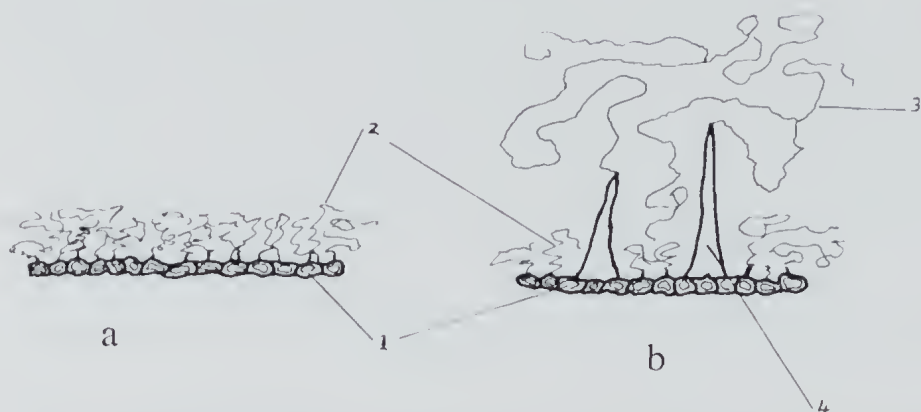


Fig. 30.—a—section through lower epidermal leaf cells of *B. salicina*; b—similar section through *B. arborescens*. (1) epidermal cells; (2) short, compact indumentum present in both spp.; (3) long, secondary layer hairs of *B. arborescens*; (4) protuberances from which secondary layer hairs arise. (All $\times 80$; diagrams drawn from observations on 4th pair seedling leaves of both spp.).

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Mr. G. M. Chippendale, past Australian Botanical Liaison Officer at Herbarium Kew was instrumental in bringing to my attention the existence of Hochreutiner's description of *B. arborescens* and I am indebted to him for his help.

My thanks are also due to the staffs of the national herbaria in Melbourne and Sydney for their help in enabling me to examine the collections of *Bedfordia* held by these institutions.

BOOK REVIEWS

Aquatic plants of Australia. A guide to the identification of the aquatic ferns and flowering plants of Australia, both native and naturalized. Helen I. Aston. Published by Melbourne University Press, 6 September, 1973.—xv, 368 pp., 138 fig., 2 maps. Recommended price: \$21.

Aquatic plants of Australia, the product of many years of painstaking work, is one of the few professionally written thematic studies on Australian plants with a taxonomic bias and it has quickly become an indispensable reference for both professional and amateur botanists.

The author opens up her study with an introduction which briefly discusses the features of an aquatic plant and the climate and physiography of Australia. She follows this with remarks on how to use her book and includes an illustrated glossary. The whole of the main text, excepting for the treatment of *Characeae* (algae) and *Ricciaceae* (hepatics) is devoted to ferns and fern allies, monocotyledons and dicotyledons. Within each of these three major groups, species are arranged alphabetically according to family and then genus. Where appropriate, keys to genera and species are provided and the leads of each couplet in the keys are clear and concise. Although a key to the families of monocotyledons and dicotyledons would have been useful, its absence does not seriously detract from the book.

Nearly half of the 222 species detailed occur in Victoria and each of these is carefully circumscribed with the greatest emphasis on the Victorian representatives. Only the least known and imperfectly understood species are described briefly. Habitat notes and general distribution data are included for most species and dot-maps added for all but a few Victorian aquatic plants. The large number of very fine line drawings prepared by the author (and a few reproduced from other texts) substantially increase the value of this book and the author is to be commended for keeping her illustrations free from excessive shading.

Appendices detailing the importance of the Water Hyacinth and its history as a serious weed in Australia, a list of sea-grasses and a distribution chart followed by an extensive bibliography and an index close this book.

The typography throughout is fresh and crisp and the format is pleasing. The author maintains an excellent balance between the text and appropriately placed illustrative material and the running headings lend further facility to its use.

Undoubtedly *Aquatic plants of Australia* is a must for everyone who has an absorbing interest in the Australian flora and in aquatic plants in particular.

—A. B. COURT

Noxious weeds of Victoria. W. T. Parsons. Published by Inkata Press, Melbourne and Sydney, 1973.—xi, 300 pp., 266 fig., 1 map and frontispiece. Recommended price: \$13.50.

The author of a book on weeds is always confronted with two difficult questions: firstly, what kind of information should he include in it, and secondly, how should he present this information to his readers. Mr. Parsons, in taking up both those challenges, has produced a very valuable reference work on the noxious weeds of Victoria and all landholders in this and adjacent states should find it a valuable manual and the farmer, especially, will find it indispensable.

Following a discussion on the characteristics of weeds generally, herbicides and then noxious weeds legislation in Section I, the author treats each noxious weed gazetted for Victoria in detail in Section II. The alphabetical arrangement follows a familial order and information on each species is given under a number of headings which include a botanical description, notes on nomenclature, history of introduction and proclamation, life cycle, distribution, dispersal, properties and control. The botanical descriptions are written in a simple manner and are readily understood by the botanically uninformed (there is a glossary for reference when necessary) and notes on nomenclature make interesting reading. The author carefully traces the history of introduction of many of these weeds and this information, hitherto widely scattered in literature and other records, will prove interesting to students concerned with this aspect of our introduced flora. Notes on life cycles, dispersal, properties and distribution, based extensively on the author's own observations, will materially assist those concerned with control and eradication of noxious weeds. The author deals with the question of control in a practical manner and indeed wisely sounds a timely note of caution on the excessive and careless use of herbicides. Wherever possible, alternative methods of control are given. All species have been adequately illustrated by colour as well as black and white photographs and sometimes coloured drawings have been added. Most of these are of very good quality. In some cases illustrations of seedling stages are included and these are particularly useful for identification purposes. The distribution of nearly every noxious weed is shown on a separate map and the presence or absence in each of Victoria's 1990 parishes is shown by a single dot.

The presentation of the material in *Noxious weeds of Victoria* is clear and logical and it will long remain a standard reference to these plants for Victoria and for Australia as well. The recommended price is very reasonable for a manual of this quality.

—A. B. COURT

